PROJECT MANUAL

SCARBOROUGH SENIOR HOUSING

480 ST CLAIR AVE
COLUMBUS, OHIO 43202

PREPARED FOR:

NATIONAL CHURCH RESIDENCES

-

PREPARED BY:

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FOR PERMIT
FEBRUARY 15, 2024

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00 43 13 - BID BOND

Know all men by these presents, that we _____
(Contractor Name & Address)

_____

as Principal, hereinafter called the Principal, and _____
(Surety Name & Address)

_____

a corporation duly organized under the laws of the State of Ohio as Surety, hereinafter called the Surety, are held and firmly bound unto _____
(Owner Name & Address)

_____

as Obligee, hereinafter called the Obligee, in the sum of _____

_____ Dollars ($ _____),
(Amount in Words) (Figures)

for the payment of which well and truly made, the said Principal and the said Surety, bind ourselves, our heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

Whereas, the Principal has submitted a bid for _____
(Project Name, Address & Description)

_____

Now, therefore, if the Obligee shall accept the bid of Principal and the Principal shall enter into a Contract with the Obligee in accordance with the terms of such bid, and give such bond or bonds as may be specified in the bidding or Contract Documents with good and sufficient surety for the faithful performance of such Contract and for the prompt payment of labor and material furnished in the prosecution thereof, or in the event of the failure of the Principal to enter such Contract and give such bond or bonds, if the Principal shall pay to the Obligee the difference not to exceed the penalty hereof between the amount specified in said bid and such larger amount for which the Obligee may in good faith contract with another party to perform the Work covered by said bid, then this obligation shall be null and void, otherwise to remain in full force and effect.

Signed and sealed this_____ day of _____ 20_____

_____
(Contractor as Principal) (Seal)

_____
(Witness)

_____
(Title) (Seal)

_____
(Surety) (Seal)

_____
(Witness)

_____
(Title) (Seal)

SECTION 00 43 25

SUBSTITUTION PROCEDURES

1.01 GENERAL

A. This Section applies to substitute products and procedures requested by the Bidder to be added during the Bid period.

1. Substitutions included with the Bid that have not been approved under this Section must be listed on the Substitution Sheet included with the Form of Proposal.
2. Provide comparable information as required to enable evaluation of the proposed substitution to the specified performance and materials. It is not the responsibility of the Architect/Engineer to further investigate claims of equivalency. Burden of proof is solely the responsibility of the proposer.

B. Requirements of this Section are in addition to the requirements of Instructions to Bidders, General Conditions and Supplementary Conditions.

C. Requirements of this Section are part of the requirements specified in Section 00 43 26 - Substitution Request Form.

1.02 LIMITATIONS ON SUBSTITUTIONS

A. Substitutions will NOT be considered unless Section 00 43 26 - Substitution Request Form attached in this Project Manual is used and the requirements of this Section and the Substitution Request Form are fully complied with.

1. Other types of forms are NOT acceptable.

B. Substitutions will NOT be considered when requested directly by subcontractor or supplier.

C. Architect will determine the acceptability of all substitutions.

1.03 REQUEST FOR SUBSTITUTIONS

A. Bidder's Representation

1. Request for substitution constitutes a representation that the Bidder has investigated the proposed product and has determined that it is equal to or superior in all respects to the specified product.
2. Request for substitution constitutes a representation that the Bidder will provide same type of warranty for substitution as for specified product.
3. Request for substitution constitutes a representation that the Bidder will coordinate the installation of the accepted substitute, making such changes

as may be required for the Work to be complete in all respects.

4. Request for substitution constitutes a representation that the Bidder waives all claims for additional costs related to substitutions which consequently become apparent.

5. Request for substitution constitutes a representation that the cost data is complete and includes all related cost under his Contract.
6. Request for substitution constitutes a representation that the Bidder has thoroughly investigated the proposed substitute to determine if license fees and royalties are pending on the proposed substitute.

B. Request for substitutions shall be submitted on Section 00 43 26 - Substitution Request Form attached in this Project Manual. Legible copies of this form shall be made as required for Bidder's submittals. Each submittal request form shall be complete with data substantiating compliance of proposed substitution with requirements of Contract Documents including the following information:

1. Project title and Architect's project number.
2. Identification of product specified including specification section and paragraph number.
3. Identification of proposed substitute complete with manufacturer's name and address, trade name of product, model or catalog number and product data.
4. List of fabricator and supplier (with address and phone number) for proposed substitute.
5. The affect of substitution on dimensions, material thickness, wiring, piping, ductwork, etc. indicated in Contract Documents.
6. The affect of substitution on other trades.
7. The affect of substitution on construction schedule.
8. Differences in quality and performance between specified product and proposed product.
9. Comparison of manufacturer's guarantees of specified product and proposed substitute.
10. Availability of maintenance services and replacement materials for proposed substitute.
11. License fees and/or royalties pending on proposed substitute.

1.04 SUBMITTAL PROCEDURES

A. Submit a separate Section 00 43 26 - Substitution Request Form for each substitution.

1. Form shall be completely and properly filled in. If form is incomplete, the Architect reserves the right to reject and return form to Bidder for completion and compliance with this section and Form 00 43 25B.
2. Submit to Architect two copies of the completed and signed form.

B. Requests for substitutions of products will be considered no later than ten (10) days prior to Bid Opening Date to allow time for Architect's evaluation of

substitutions and the preparation of an addendum, if required.

C. Architect will issue the Addendum to all Bidders to notify them of the Architect's decision to accept the requested substitution.

END OF SECTION

SECTION 00 43 26

SUBSTITUTION REQUEST FORM

GENERAL: This form is part of the substitution requirements specified in Section 00 43 25. This form is for PRE-BID substitution requests only.

PROJECT TITLE & NO. _____

_____

_____

TO:MOODY NOLAN INC.
300 Spruce Street, Suite 300
Columbus, Ohio 43215
Telephone (614) 461-4664 FAX (614) 280-8881
Contact and Email: Rick Krall (RKrall@moodynolan.com)

ATTN: _____

SPECIFIED ITEM _____

Section _____ Paragraph _____

PROPOSED SUBSTITUTE _____

_____

Attach complete description, catalog, spec data, and laboratory tests if applicable

1. What effect will substitution have on dimensions, gauges, weights, etc. indicated in Contract Documents?

   _____

   _____

2. What effect will substitution have on wiring, piping, ductwork, etc. indicated in Contract Documents?

   _____

   _____

3. What effect will substitution have on other trades? _____

   _____

4. What effect will substitution have on construction schedule? _____

5. What are the differences in quality and performance between proposed substitute and specified product? _____

6. Manufacturer's guarantees of the specified products and proposed products are:
   Same: _____ Different (Explain) _____

8. List (on separate sheet), if applicable, the availability of maintenance services and replacement materials for proposed substitute.

9. List (on separate sheet) names, addresses and phone numbers of fabricators and suppliers for proposed substitutes.

10. There [are ___] [are no ___] license fees and royalties pending on the proposed substitute. (Explain)

11. The undersigned certifies that this substitution meets all requirements of the Contract Documents except as specifically noted herein.

    SUBMITTED TO BIDDER BY: (Supplier/Fabricator)

    Firm _____

    Address _____

    Name and Title of Person Signing _____

    Signature _____

    Telephone No. _____ Date _____

    SUBMITTED TO ARCHITECT BY: (Bidder)

    Firm _____

    Address _____

    Name and Title of Person Signing _____

    Signature _____

Telephone No. _____ Date _____

FAX No. _____ Email _____

12. ARCHITECT/ENGINEER'S REVIEW COMMENTS:

___ Tentatively Accepted (pending issuance of Addendum)

___ Rejected due to incomplete form.

___ Not Accepted

___ Received Too Late

Signature _____

Date _____

Remarks _____

_____

_____

_____

END OF SECTION

SECTION 00 45 13

BIDDER QUALIFICATION STATEMENT

A. Contractor Qualification Statement: AIA Document A305, 1986 Edition; 6 pages and the supplements as specified herein below.

1. Bidders desiring to perform the work under this Contract must complete and submit with their bid the qualification statement referenced herein.
2. Bidders seeking approval as a qualified Contractor on this project shall provide the following information in addition to AIA Document A305:
    a. Experience of the Contractor:
        1) Period of time the Company has been performing the type of work required in this section as a Contractor.
        2) Resume of the lead craftsman(men) who will implement the work.
        3) Complete list of comparable completed projects and scope of work. Identify for each project:
            a) Project name and address.
            b) Facility contact person and telephone number.
            c) Type of work (e.g., products, materials and finishes) installed.
            d) Special project conditions, including layout, finishes, performance requirements, and other special project requirements.
    b. Contractors are cautioned that only experienced Contractors that can submit satisfactory documentation of comparable completed work of the type required for the work of this project will be considered for approval.
        1) Furnish a written outline of their understanding of the challenges and unique aspects of this project and their proposed methods for achieving the end results required for this portion of the work.
        2) Provide documentation that the Contractor has ten (10) years of wood window replacement and renovation work experience on historical structures in performing work of this skill level and dollar volume.
    c. Failure to meet these requirements and qualifications will be sufficient cause for rejection as an approved bidder.

END OF SECTION

SECTION 00 11 13

SUPPLEMENTARY CONDITIONS

Download current Special Conditions from OFCC (Ohio Facilities Construction Commission) website.

http://ofcc.ohio.gov/Documents.aspx
current 6/10/2014

SECTION 00 90 15

PREVAILING WAGE RATES

The Contractor shall pay the prevailing wage rates of the Project locality, as determined by the Ohio Bureau of Employment Services, Wage and Hour Division, to all laborers performing work on the Project.

a. The Contractor shall comply with the provisions, duties, obligations, and is subject to the remedies and penalties of Chapter 4115, ORC, "Wages and Hours on Public Works."

b. Prevailing wage rates and information are available to all bidders on the internet at https://wagehour.com.ohio.gov/w3/webwh.nsf/wrlogin/?openform

c. The Contractor shall submit all payroll reports in compliance with the requirements of the Modified General Conditions of the Contract and the Ohio Revised Code.

The bidder agrees to all the above provision by signing below.

_____
Company

_____ _____
Signature Date

_____
Name Printed

SECTION 01 11 00

SUMMARY OF WORK

PART 1 GENERAL

1.01 GENERAL PROJECT DESCRIPTION

A. Project Description: This project consists of construction of a four-story 80+ unit multi-family residential building for senior housing, with elevator, and community spaces. The site is located at 480 St Clair Ave., Columbus, OH 43202. Exterior surface parking provided with access from alley.

B. LEED Silver desired project.

1.02 PRIME CONTRACT

A. Single Prime contract.

1.03 WORK SEQUENCE

A. General Contractor: Prepare a detailed construction procedure and schedule and submit it to the Architect for approval. Such procedure and schedule must be approved in writing prior to the start of construction work.

B. Other Contractors: Cooperate with the Prime Contractor in preparing this schedule and procedures.

C. See General Conditions, Article 14 and Specification Section 01 32 16

1.04 MISCELLANEOUS PROVISIONS

A. Performance Requirements for Completed Work: Provide the final and completed project complete and ready for use in every respect by the completion date specified herein.

1. Contract Documents indicate the intended occupancy and utilization of the building and its individual systems and facilities. Compliance with all applicable governing regulations, codes and standards is intended and required for the work and for the Owner's occupancy and utilization.
2. In addition to the requirement that every element of the work comply with applicable requirements of the Contract Documents, it is also required that the work as a whole comply with all applicable industry standards and governing codes and regulations.

END OF SECTION

SECTION 01 23 00

ALTERNATES

PART 1 GENERAL

1.01 SUMMARY

A. Section includes administrative and procedural requirements for alternates.

1.02 GENERAL REQUIREMENTS

A. Definitions and Explanations: "Alternates" are defined as alternate products, materials, equipment, systems, methods, units of work or major elements of the construction, which may, at Owner's option and under terms established by Instructions to Bidders and in the Contract or Agreement, be selected for the work in lieu of corresponding requirements of Contract Documents. Selection may occur prior to Contract date, or may, by the Agreement, be deferred for possible selection at a subsequent date. Alternates may or may not change scope and general character of the work substantially. Requirements of this section may be related to, but must not be confused with, requirements of Contract Documents related to "allowances", "unit prices", change orders", "substitutions" and similar provisions.

1. Refer to the Contract, and subsequent modifications thereof, for determination of which several scheduled "Alternates" herein have been accepted, and, therefore, are in full force and effect as though included originally in the contract documents for the base bid.
2. The Owner reserves the right to accept or reject any Alternate at the time of awarding the Contract. If, during the progress of the Work, it should become desirable to reinstate any Alternate not included in the Contract, the Owner reserves the right to reinstate the Alternate at the price bid by the Contractor provided that such actions taken in sufficient time as not to delay the progress of the work.

B. Notification: Immediately following the award of the Contract, prepare and distribute to each entity to be involved in performance of the work, a notification of the status of each alternate scheduled herein and including those subsequently added by notification during bidding. Indicate which alternates have been: 1) accepted, 2) rejected, and, 3) deferred for consideration at a later date as indicated. Include full description of negotiated modifications to alternates, if any.

C. General: The descriptions herein for each alternate are recognized to be incomplete and abbreviated, but imply that each change must be complete for the scope of work affected. Refer to all other applicable specification sections and to applicable drawings, for specific requirements of the work, regardless of whether references are so noted in the description of each alternate.

It is recognized that descriptions of alternates are primarily scope definitions, and do not necessarily detail full range of materials and processes needed to complete the work as required.

1.02 SCHEDULE OF ALTERNATES

A. Contract Alternates

1. Alternate No. 1: Deduct - Microwave Circuits
   a. Do not install the dedicated Microwave branch circuits and receptacles. This would allow tenants to provide their own microwaves, utilizing the (2) 20 amp general use/small appliance countertop receptacle circuits in each kitchen, per NEC. *Note that tenants may experience nuisance breaker-tripping if something high in wattage like a tea kettle or toaster is running at the same time on the same circuit.*

END OF SECTION

SECTION 01 25 00

SUBSTITUTION PROCEDURES

PART 1 GENERAL

1.01 SUMMARY

A. Section includes administrative and procedural requirements for substitutions permitted after the bidding phase.

1. Provide comparable information as required to enable evaluation of the proposed substitution to the specified performance and materials. It is not the responsibility of the Architect/Engineer to further investigate claims of equivalency. Burden of proof is solely the responsibility of the proposer.

1.02 RELATED SECTIONS

A. Related Sections

1. Product Requirements (for requirements for submitting comparable product submittals for products by listed manufacturers): Section 01 60 00.
2. Divisions 02 through 49 Sections for specific requirements and limitations for substitutions.

1.03 DEFINITIONS

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

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

1.04 SUBMITTALS

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

1. Substitutions During the Bidding Phase: See Section 00 43 25.
2. Substitutions After the Bidding Phase: After the Contract has been executed, the Owner will consider a formal request for the substitution of

products in place of those specified only under the conditions set forth in this paragraph. Where materials, equipment, apparatus, or other products are specified by manufacturer, brand name, type or catalog number, such designation shall establish standards of quality and style desired. Any reasonable request for substitution will be considered, if in the opinion of the Architect, such materials are equal to the material specified and entirely satisfactory for use in the project. The Architect shall be the sole judge of acceptability of substitution.

a. By making requests for substitutions based on paragraph 1 above, the Contractor:
   1) Represents that he has personally investigated the proposed substitute product and determined that it is equal or superior in all respects to that specified;
   2) Represents that he will provide the same warranty for the substitution that the Contractor would for that specified;
   3) Certifies that the cost data presented is complete and includes all related costs under this Contract but excludes the Architect's re-design costs, and waives all claims for additional costs related to the substitution which subsequently become apparent; and
   4) Will coordinate the installation of the accepted substitute, making such changes as may be required for the work to be complete in all respects, without any additional time being added to the contract schedule.

b. The Architect will reply in writing to the Contractor stating whether the Owner, after due investigation, has reasonable objection to any such proposal. If adequate data on any proposed manufacturer or installer is not available, the Architect may state that action will be deferred until the Contractor provides further data. Failure of the Owner to reply will constitute notice of non-acceptance. Written acceptance of substitution will not constitute a waiver of any of the requirements of the Contract Documents, and all products furnished by the listed manufacturer must comply with such requirements.

c. Timing: 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. If necessary, Architect will request additional information or documentation for evaluation within 7 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 7 days of receipt of additional information or documentation, whichever is later.

d. Substitution Request Form: Use Section 01 25 01 Substitution Request Form provided at end of this Section.

e. Form of Acceptance: Change Order.

2. Contractor’s Substitution Documentation: Show compliance with requirements for substitutions and the following, as applicable:
   a. Statement indicating why specified material or product cannot be provided.
   b. Coordination information, including a list of changes or

modifications needed to other parts of the Work and to construction performed by Owner and separate contractors, that will be necessary to accommodate proposed substitution.

c. Detailed comparison of significant qualities of proposed substitution with those of the Work specified. Significant qualities may include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.

d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.

e. Samples, where applicable or requested.

f. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners.

g. Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.

h. Research/evaluation reports evidencing compliance with building code in effect for Project, from a model code organization acceptable to authorities having jurisdiction.

i. Detailed comparison of Contractor's Construction Schedule using proposed substitution with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating lack of availability or delays in delivery.

j. Cost information, including a proposal of change, if any, in the Contract Sum.

k. Contractor's certification that proposed substitution complies with requirements in the Contract Documents and is appropriate for applications indicated.

l. 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.

1.05 QUALITY ASSURANCE

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

1.06 PROCEDURES

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

PART 2 PRODUCTS

2.01 SUBSTITUTIONS

A. Substitutions for Cause: Submit requests for substitution immediately upon

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 3 EXECUTION (Not Used)

END OF SECTION

SECTION 01 25 01

SUBSTITUTION REQUEST FORM

GENERAL: This form is part of the substitution requirements specified in Section 01 25 00.

PROJECT TITLE & NO. _____

_____

_____

TO:MOODY NOLAN INC.
300 Spruce Street, Suite 300
Columbus, Ohio 43215
Telephone (614) 461-4664 FAX (614) 280-8881
Contact and Email: **[add contact name and email address]**

ATTN: _____

SPECIFIED ITEM _____

Section _____ Paragraph _____

PROPOSED SUBSTITUTE _____

_____

Attach complete description, catalog, spec data, and laboratory tests if applicable

1. What effect will substitution have on dimensions, gauges, weights, etc. indicated in Contract Documents?

   _____

   _____

2. What effect will substitution have on wiring, piping, ductwork, etc. indicated in Contract Documents?

   _____

   _____

3. What effect will substitution have on other trades? _____

   _____

4. What effect will substitution have on construction schedule? _____

5. What are the differences in quality and performance between proposed substitute and specified product? _____

6. Manufacturer's guarantees of the specified products and proposed products are:
   Same: _____ Different (Explain) _____

7. What are the differences in all sustainable design characteristics and performance between proposed substitute and specified product? _____

8. List (on separate sheet), if applicable, the availability of maintenance services and replacement materials for proposed substitute.

9. List (on separate sheet) names, addresses and phone numbers of fabricators and suppliers for proposed substitutes.

10. There [are ___] [are no ___] license fees and royalties pending on the proposed substitute. (Explain)

11. The undersigned certifies that this substitution meets all requirements of the Contract Documents except as specifically noted herein.

    SUBMITTED TO BIDDER BY: (Supplier/Fabricator)

    Firm _____

    Address _____

    Name and Title of Person Signing _____

    Signature _____

    Telephone No. _____ Date _____

    SUBMITTED TO ARCHITECT BY: (Bidder)

    Firm _____

Address _____

Name and Title of Person Signing _____

Signature _____

Telephone No. _____ Date _____

FAX No. _____ Email _____

12. ARCHITECT/ENGINEER'S REVIEW COMMENTS:

___ Tentatively Accepted (pending issuance of Addendum)

___ Rejected due to incomplete form.

___ Not Accepted

___ Received Too Late

Signature _____

Date _____

Remarks _____

_____

_____

_____

END OF SECTION

SECTION 01 29 00

PAYMENT PROCEDURES

PART 1 GENERAL

1.01 SUMMARY

A. This Section includes administrative and procedural requirements governing the Contractors' Application for Payment.

B. Each Contractor: Coordinate the Schedule of Values and Applications for Payment with the Construction Schedule, List of Subcontracts and Submittal Schedule.

1.02 RELATED SECTIONS

A. Construction Schedules: Section 01 32 16.

1.03 SCHEDULE OF VALUES

A. Contractor: Coordinate preparation of Schedule of Values for its part of the work with preparation of Construction Schedule.

1. Correlate line items in the Schedule of Values with other required administrative schedules and forms, including:
   a. Contractor's construction schedule
   b. Application for payment form, including continuation sheets.
   c. List of subcontractors.
   d. Schedule of allowances.
   e. Schedule of Alternates.
   f. List of products.
   g. List of principal suppliers and fabricators.
   h. Schedule of submittals.
2. Submit Schedule of Values to Architect at the earliest possible date, but no later than 2 days before the date scheduled for pre-construction meeting.

B. Form and Content: Use the Project Manual Table of Contents as a guide to establish the format for the Schedule of Values. Provide at least one line item for each specification section.

1. Identification: Include the following project identification on the Schedule of Values:
   a. Project name and location.
   b. Name of Architect.
   c. Project number.
   d. Contractor's name and address.
   e. Date of submittal.

2. Arrange the Schedule of Values in a tabular form with separate columns to indicate the following for each item listed:
   a. Related specification section.
   b. Description of work.
   c. Name of subcontractor.
   d. Name of supplier or fabricator.
   e. Name of supplier.
   f. Change Orders (numbers) that have affected value.
   g. Dollar value.
   h. Percentage of contract sum to the nearest one-hundredth percent, adjusted to total 100 percent.
3. Provide a breakdown of the contract sum in sufficient detail to facilitate continued evaluation of Applications for Payment and progress reports. Coordinate with the Project Manual Table of Contents. Break principal subcontract amounts down into several line items.
4. Round amounts off to the nearest whole dollar; the total shall equal the Contract Sum.
5. 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. Include requirements for insurance and bonded warehousing, if required.
6. Provide separate line items on the Schedule of Values for initial cost of the materials, for each subsequent stage of completion, and for total installed value for that part of the work.
7. Margins of Cost: Show line items for indirect costs, and margins of actual costs, only when such items are listed individually in Applications for Payment. Each item in the Schedule of Values and Application for Payment shall be complete. Include the total cost and proportionate share of general overhead and profit margin for each item.
   a. At the Contractor's option, temporary facilities and other major cost items that are not direct cost of actual work-in-place may be shown as separate line items in the Schedule of Values or distributed as general overhead expense.
8. Schedule Updating: Update and resubmit the Schedule of Values when Change Orders or Construction Change Directives result in a change in the Contract Sum.

1.04 APPLICATIONS FOR PAYMENT

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

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

B. Payment Application Times: The date for each progress payment applications is

the last day of each month. The period covered by each application for payment starts on the day following the end of the preceding period.

C. Payment Application Forms: AIA G702 and G703.

D. Application Preparation: Complete every entry on the form, including notarization and execution by person authorized to sign legal documents on behalf of the Owner. Incomplete applications will be returned without action.

1. Entries shall match data on the Schedule of Values and Contractor's Construction Schedule. Use updated schedules if revisions have been made.
2. Include amounts of Change Orders and Construction Change Directives issued prior to the last day of the construction period covered by the application.

E. Transmittal: Submit signed and notarized original copy of each Application for Payment to the Architect by a method ensuring receipt within 24 hours. One copy shall be complete, including waivers of liens and similar attachments, when required.

1. Transmit each copy with a transmittal form listing attachments, and recording appropriate information related to the application in a manner acceptable to the Architect.

F. Waivers of Mechanics Lien: With each Application for Payment submit waivers of mechanics liens from every entity who is lawfully entitled to file a mechanics lien arising out of the contract and related to the Work covered by the payment.

1. Submit partial waivers on each item for the amount requested, prior to deduction for retainage, on each item.
2. When an application shows completion of an item, submit final or full waivers.
3. The Owner reserves the right to designate which entities involved in the Work must submit waivers.
4. Waiver Delays: Submit each Application for Payment with the Contractor's waiver of mechanics lien for the period of construction covered by the application.
    a. Submit final Application for Payment with or preceded by final waivers from every entity involved with performance of Work covered by the application who could lawfully be entitled to a lien.
5. Waiver Forms: Submit waivers of lien on forms, and executed in a manner, acceptable to the Owner.

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

1. List of subcontractors.

2. List of principal suppliers and fabricators.
3. Schedule of Values.
4. Contractor's Construction Schedule (preliminary if not final).
5. Schedule of major products.
6. List of Contractor's staff assignments.
7. Copies of building permits.
8. Copies of authorizations and licenses from governing authorities for performance of the work.
9. Initial progress report.
10. Report of pre-construction meeting.
11. Certificates of Insurance and insurance policies.

H. Application for Payment at Substantial Completion: Following issuance of the Certificate of Substantial Completion, submit an Application for Payment; this application shall reflect any Certificates of Partial Substantial Completion issued previously for Owner occupancy of designated portions of the Work.

I. Administrative actions and submittals that shall proceed or coincide with this application include:

1. Occupancy permits and similar approvals.
2. Warranties (guaranties) and maintenance agreements.
3. Test/adjust/balance records.
4. Maintenance instructions.
5. Start-up performance reports.
6. Change-over information related to Owner's occupancy, use, operation and maintenance.
7. Final cleaning.
8. Application for reduction of retainage, and consent of surety.
9. Advice on shifting insurance coverage.
10. List of incomplete work, recognized as exceptions to Architect's Certificate of Substantial Completion.

J. Final Payment Application: Administrative actions and submittals which must proceed or coincide with submittal of the final payment Application for Payment include the following, as applicable:

1. Completion of project close-out requirements.
2. Completion of items specified for completion after Substantial Completion.
3. Ensure that unsettled claims will be settled.
4. Ensure that work not complete and accepted will be completed without undue delay.
5. Transmittal of required Project construction records to Owner.
6. Proof that fees and similar obligations have been paid.
7. Removal of temporary facilities and services.
8. Removal of surplus materials, rubbish and similar elements.
9. Change of door locks to Owner's access.

END OF SECTION

SECTION 01 31 00

PROJECT MANAGEMENT AND COORDINATION

PART 1 GENERAL

1.01 SUMMARY

A. This 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. Administrative and supervisory personnel.
4. Requests for Interpretation (RFIs).
5. Pre-Installation Conferences.

B. Each contractor shall participate in coordination requirements. Certain areas of responsibility may be assigned to a specific contractor.

1.02 RELATED SECTIONS

A. Project Meetings: Section 01 31 19.

1.03 DEFINITIONS

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

1.03 INFORMATIONAL SUBMITTALS

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

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

1.03 GENERAL COORDINATION PROCEDURES

A. 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 with other contractors to ensure maximum accessibility for required maintenance, service, and repair.
3. Make adequate provisions to accommodate items scheduled for later installation.
4. Where availability of space is limited, coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair of all components, including mechanical and electrical.

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

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

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

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

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

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

1.04 COORDINATION DRAWINGS

A. Coordination Drawings: Prepare Coordination Drawings if limited space availability necessitates maximum utilization of space for efficient installation of different components or if coordination is required for installation of products and materials fabricated by separate entities.

1. Content: Project-specific information, drawn accurately to scale. Do not base Coordination Drawings on reproductions of the Contract Documents or 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. Indicate functional and spatial relationships of components of architectural, structural, civil, mechanical, and electrical systems.
   c. Indicate required installation sequences and for anticipated replacement of components during the life of the installation.
   d. Show location and size of access doors required for access to concealed dampers, valves, and other controls.
   e. Indicate required installation sequences.
   f. Indicate dimensions shown on the Contract Drawings and make specific note of dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements. Provide sketches to Architect for resolution of such conflicts. Minor dimension changes and difficult installations will not be considered changes to the Contract.
   g. Complete sufficient demolition to confirm dimensions and clearances before submitting drawings.
   h. Preparation of coordination drawings of the Work specified in divisions 21 through 28 shall include the following procedure:
      1) Ductwork shop drawings shall be prepared indicating bottom of duct elevations.
      2) A reproducible of these drawings shall be given to the sub-contractors responsible for Division 21 through Division 28 work, and they shall each review the drawing for conflicts with their work.
      3) Contractor shall hold coordination meetings at which coordination conflicts will be resolved. Contractor to document agreed to coordination resolution.
      4) Installation of work may not proceed without resolution of coordination conflicts by the Contractor. Work not installed in accordance with the agreed to coordination documents is subject to replacement if conflicts remain, with related costs borne by the Contractor.

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 ceiling plenum to accommodate layout of light fixtures 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. Show plumbing lines. Notate code required slope elevations.
    c. Dimensions of major components, such as dampers, valves, diffusers, access doors, cleanouts and electrical distribution equipment.
    d. 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 and racks of smaller conduit are required.
    b. Light fixture, exit light, emergency battery pack, smoke detector, and other fire-alarm locations.
    c. Panel board, switch board, 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 locations of standpipes, mains piping, branch lines, pipe drops, sprinkler heads and inspected test valve drains.
9. Review: Consultant will review coordination drawings to confirm that the Work is being coordinated, but not for the details of the coordination, which are Contractor's responsibility. If Consultant determines that coordination drawings are not being prepared in sufficient scope or detail, or are otherwise deficient, Consultant will so inform Contractor, who shall make changes as directed and resubmit.

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

1. File Preparation Format: Same digital data software program, version, and operating system as original Drawings or program and system as approved by Architect.
2. File Submittal Format: Submit or post coordination drawing files using Portable Data File (PDF) format.
3. BIM File Incorporation: Develop and incorporate coordination drawing files into Building Information Model established for Project.
    a. Perform three-dimensional component conflict analysis as part of preparation of coordination drawings. Resolve component conflicts prior to submittal. Indicate where conflict resolution requires modification of design requirements by Architect.
4. Architect will furnish Contractor one set of digital data files of Drawings for use in preparing coordination digital data files.

a. Architect makes no representations as to the accuracy or completeness of digital data files as they relate to Drawings.
b. Execute a data licensing agreement in the form of Agreement form acceptable to Owner and Architect.

1.05 ADMINISTRATIVE AND SUPERVISORY PERSONNEL

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

1. Include special personnel required for coordination of operations with other contractors.

1.06 REQUESTS FOR INFORMATION (RFIs)

A. Procedure: Immediately on discovery of the need for interpretation of the Contract Documents, and if not possible to request interpretation at Project meeting, prepare and submit an RFI in the form specified.

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

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

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

C. Hard-Copy RFIs: Identify each page of attachments with the RFI number and sequential page number.

D. Software-Generated RFIs: Software-generated form with substantially the same

content as indicated above.

1. Attachments shall be electronic files in Adobe Acrobat PDF format.

E. Architect's Action: Architect will review each RFI, determine action required, and return it. Allow 15 calendar days for Architect's response for each RFI. RFIs received after 1:00 p.m. will be considered as received the following working day.

1. The following 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 RFIs with numerous errors.
2. Architect's action may include a request for additional information, in which case Architect's time for response will start again.
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 Division 01 Section "Contract Modification Procedures."
   a. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Architect in writing within 10 days of receipt of the RFI response.

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 7 days if Contractor disagrees with response.

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

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

1.07 PREINSTALLATION CONFERENCE

A. Conduct a preinstallation conference at Project site before each construction activity that requires coordination with other construction, and where required in individual specification Sections.

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 problems.
   k. Time schedules.
   l. Weather limitations.
   m. Manufacturer's written recommendations.
   n. Warranty requirements.
   o. Compatibility of materials.
   p. Acceptability of substrates.
   q. Temporary facilities and controls.
   r. Space and access limitations.
   s. Regulations of authorities having jurisdiction.
   t. Testing and inspecting requirements.
   u. Installation procedures.
   v. Coordination with other work.
   w. Required performance results.
   x. Protection of adjacent work.
   y. Protection of construction and personnel.
3. Record significant conference discussions, agreements, and disagreements, including required corrective measures and actions.
4. Reporting: Distribute minutes of the meeting to each party present and to parties who should have been present.
5. Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 01 31 19

PROJECT MEETINGS

PART 1 GENERAL

1.01 SCOPE

A. This section specifies administrative and procedural requirements for project meetings including:

1. Pre-Construction Meeting.
2. Progress Meetings.
3. Specially called meetings.

1.02 RELATED SECTIONS

A. Project Management and Coordination: Section 01 31 00.

1.03 DESCRIPTION

A. Duties of Architect: Attend preconstruction, progress and specially called meetings.

B. Duties of General Contractor: Schedule and administer preconstruction meeting, progress meetings and specially called meetings throughout the progress of the work. Make physical arrangements for meetings.

1. Prepare agenda for meetings.
2. Preside at meetings.
3. Record the minutes; include all significant proceedings and decisions.
4. Reproduce and distribute copies of minutes.
   a. To all participants in the meeting.
   b. To all parties affected by decisions made at the meeting.

C. Representatives of the Contractors, subcontractors and suppliers attending the meetings shall be qualified and authorized to act on behalf of the entity each represents.

1.04 PRE-CONSTRUCTION MEETING

A. Scheduled within 15 days after date of Notice to Proceed.

B. Location: A central site, convenient for all parties, designated by Contractor.

C. Attendance

1. Owner's Representative

2. Architect and Consultants
3. Prime Contractors' Superintendents
4. Major Subcontractors
5. Major Suppliers

D. Agenda: Discuss items of significance that could affect progress, including the following:

1. Tentative construction schedule.
3. Critical work sequencing and long-lead items.
4. Designation of key personnel and their duties.
5. Lines of communications.
5. Procedures for processing field decisions and Change Orders.
6. Procedures for RFIs.
7. Procedures for testing and inspecting.
8. Procedures for processing Applications for Payment.
9. Distribution of the Contract Documents.
10. Submittal procedures.
11. Preparation of Record Documents.
12. Use of the premises.
13. Work restrictions.
14. Working hours.
15. Responsibility for temporary facilities and controls.
16. Procedures for moisture and mold control.
17. Procedures for disruptions and shutdowns.
18. Construction waste management and recycling.
19. Parking availability and restrictions.
20. Office, work, and storage areas.
21. Equipment deliveries and priorities.
22. First aid.
23. Security.
24. Progress cleaning.
25. Owner's occupancy requirements.
26. Phasing.

1.05 PROGRESS MEETINGS

A. Schedule regular periodic meetings, as required.

B. Hold called meetings as required by progress of work.

C. Location of the Meetings: Project field office of the General Contractor.

D. Attendance

1. Architect and consultants as needed.
2. Prime Contractors.
3. Subcontractors as appropriate to the agenda.
4. Suppliers as appropriate to the agenda.

5. Owner's Representative

E. Suggested Agenda

1. Review, approval of minutes of previous meeting.
2. Review of work progress since previous meeting.
3. Field observations, problems, conflicts.
4. Problems which impede Construction Schedule.
5. Review of off-site fabrication, delivery schedules.
6. Corrective measures and procedures to regain projected schedule.
7. Revisions to Construction Schedule.
8. Plan progress, schedule, during succeeding work period.
9. Coordination of schedules.
10. Review submittal schedules; expedite as required.
11. Maintenance of quality standards.
12. Review proposed changes for:
    a. Effect on Construction Schedule and on completion date.
    b. Effect on other contracts of the project.
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.
19. LEED

1.06 PRE-INSTALLATION CONFERENCES

A. Section 01 31 00.

END OF SECTION

SECTION 01 32 16

CONSTRUCTION SCHEDULES

PART 1 GENERAL

1.01 GENERAL REQUIREMENTS

A. These requirements generally describe the form of the construction schedule, a basic description of the schedule contents and the submittal procedures. This Section is a supplement to Paragraph 3.10 and other paragraphs of the General Conditions. Refer to General Conditions for additional requirements regarding the Contractor's necessity to maintain the approved construction schedule and the project completion.

B. Authorization to proceed with the work will not be given until the construction schedule has been approved by the Architect.

C. General Contractor: Provide a coordinated project construction schedule for the entire work.

D. Coordination

1. Submit schedule to each Prime Contractor for review.
2. Coordinate schedule with schedules of each Prime Contractor.
3. Resolve conflicts among schedules of Prime Contractors.
4. Obtain signature of each Prime Contractor indicating their approval of the schedule prior to submission to Architect for review.
5. Complete coordination of all items described above before submitting schedule to Architect for review.

1.02 FORM OF SCHEDULES

A. Prepare schedules in the form of a time-scaled logic diagram, defined as a network logic diagram with connecting lines specifically identifying relationships between all activities of the work using the "Critical Path Method".

1. Diagram may be machine plotted or hand drafted showing the activities duration time-scaled to the appropriate calendar in an easily readable format as approved by Architect. Base schedule on the early start early finish dates of the activities. All relationships between activities must be clearly noted including associated lag times, if required. The diagram must also have the critical path (the series of activities with the least value of total float) clearly marked. In addition, the Contractor must provide a tabular report indicating the early start, early finish, late start, late finish, and total float for every activity in the schedule.

1.03 CONTENT OF SCHEDULES

A. Quantity of Activities: Defined by complexity of the project. An adequate number of activities are to be included in the project in order that sufficient detail of the demolition process (and resulting temporary construction) and weekly progress requirements are clearly stated.

B. Where applicable, progress schedule must also include a shop drawing schedule with the activities "Prepare Shop Drawings", "Architect Review and Approval", and "Fabricate and Deliver to the Jobsite". This sequential series of activities must be assigned to each item on the project which requires a shop drawing or performance data submittal prior to its installation. The shop drawing schedule shall be tied directly to the progress schedule, but shall be provided to the Architect as a separate time-scaled logic diagram.

C. Architect reserves the right to request that the schedule of activities be presented in a different format or organization than described above.

1.04 PROGRESS REVISIONS

A. Update schedule and submit in the above format each month with pay requests. Progress completion shall be defined as the remaining duration of any activity which started on or before the schedule update. In addition, revise the duration of all activities as more accurate scheduling information becomes available.

1. Indicate progress of each activity to date of submission.
2. Show changes occurring since previous submission of schedule:
    a. Major changes in scope.
    b. Activities modified since previous submission.
    c. Revised projections of progress and completion.
    d. Other identifiable changes.

B. Provide a narrative report as needed to define:

1. Problem areas, anticipated delays, and the schedule.
2. Corrective action recommended, and its effect.
3. The effect of changes on schedules of other prime contractors.

1.05 SUBMITTALS

A. Submit initial schedules within 15 days after award of Contract.

1. Architect will review schedules and return review copy within 10 days after receipt.
2. If required, resubmit within 7 days after return of review copy.

B. Submit revised progress schedules with each application for payment.

C. Submit four opaque copies of initial schedule, large enough to show entire schedule for entire construction period.

1. Submit an electronic copy of schedule, using software indicated, in .pdf format. Include type of schedule (Initial or Updated) and date on label.

1.06 DISTRIBUTION

A. Distribute copies of the reviewed schedules to:

1. Job site file.
2. Prime contractors.
3. Subcontractors.
5. Owner.
5. Architect.
6. Other concerned parties.

END OF SECTION

SECTION 01 33 23

SHOP DRAWINGS, PRODUCT DATA AND SAMPLES

PART 1 GENERAL

1.01 SUMMARY

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

1.02 DEFINITIONS

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

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

1.03 GENERAL REQUIREMENTS

A. Requirements of this Section are in addition to the requirements of the General Conditions.

B. This Section includes procedures for processing:

1. Shop drawings.
2. Product data.
3. Samples.
4. Certificates of compliance.
5. Reports.
6. Schedules.
7. Design data.
8. Other submittals listed.

C. Submittals reviewed without exceptions do not constitute a change order.

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

1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
2. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.

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

E. Submittals Schedule: See Section 01 32 16, Construction Schedules, for list of submittals and time requirements for scheduled performance of related construction activities.

1. Submittals received prior to receipt of the initial Submittals Schedule will be rejected.
2. Submittals received prior to the time they are indicated on the Submittal Schedule to be submitted will be rejected.

F. Make all submittals far enough in advance of scheduled dates for installation to provide sufficient time for reviews, for securing necessary reviews, for possible revisions and resubmittals, and for placing orders and securing delivery.

1. Provide samples via postal or delivery service to Architect or appropriate consultant for their review.
2. Delays caused by the tardiness of the Contractor in preparing and forwarding submittals will not be an acceptable basis for an extension of the Contract completion date or for consideration of alternate products which do not meet the specified requirements of this Project Manual.
3. Initial Review: Allow 14 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.
4. Intermediate Review: If intermediate submittal is necessary, process it in same manner as initial submittal.
5. Resubmittal Review: Allow 14 days for review of each resubmittal.
6. Sequential Review: Where sequential review of submittals by Architect's consultants, Owner, or other parties is necessary, allow 14 days for initial review of each submittal.
7. Concurrent Consultant Review: Where the Contract Documents indicate that submittals may be transmitted simultaneously to Architect and to Architect's consultants, allow 14 days for review of each submittal. Submittal will be returned to Architect before being returned to Contractor.

G. Identification: Use Submittal Review Cover (Section 01 34 00) and attach to each submittal for identification.

1. Fill out Submittal Review Cover completely. Indicate name of firm or entity that prepared each submittal on label or title block.

H. Notify Architect in writing at time of submittal of deviations from the requirements of the Contract Documents. In addition, highlight, encircle, or otherwise specifically identify deviations.

I. Transmittal: Package each submittal individually and appropriately for transmittal and handling. Transmit each submittal using Submittal Review Cover (Section 01 34 00). Architect will return any submittals, without review, that were received without Submittal Review Cover, from sources other than Contractor, or without a Contractor Certification stamp.

1. Transmittal Form: Provide locations on form for the following information:
   a. Project name.
   b. Date.
   c. Destination (To:).
   d. Source (From:).
   e. Names of subcontractor, manufacturer, and supplier.
   f. Category and type of submittal.
   g. Submittal purpose and description.
   h. Specification Section number and title.
   i. Drawing number and detail references, as appropriate.
   j. Submittal and transmittal distribution record.
   k. Remarks.
   l. Signature of transmitter.
2. On an attached separate sheet, prepared on Contractor's letterhead, record relevant information, requests for data, revisions other than those requested by Architect on previous submittals, and deviations from requirements in the Contract Documents, including minor variations and limitations. Include same label information as related submittal.

J. Resubmittals: When Architect requires that a submittal be resubmitted, comply with requirements of this section.

1. Identify changes made since the previous submittal.

K. 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.

L. Digital Documents: At Contractor's written request, copies of Architect's Digital Documents will be provided to Contractor for Contractor's use in connection with Project, subject to the following conditions:
1. Execute Agreement & Waiver Release of Digital Documents provided by the Architect to obtain files.
2. The digital documents are provided for the Contractor’s convenience and their use will be at the Contractors risk.
   a. There are no assurances that the information in the digital documents is current. All dimensions must be field-verified.

J. Electronic PDF Submittals: When acceptable, prepare submittals as PDF package, incorporating complete information into each PDF file. Name PDF file with submittal number.

K. Submittals for Web-Based Project Software: When acceptable, prepare submittals as PDF files, or other format indicated by Project software website.

1.04 ACTION SUBMITTALS

A. General: Prepare and submit Action Submittals required by individual Specification Sections.

B. Product Data

1. Submit only pages which are pertinent.
   a. Mark each copy of standard printed data to identify pertinent products, referenced to Specification Section and Article number.
   b. Show reference standards, performance characteristics, and capacities; wiring and piping diagrams and controls; component parts; finishes; dimensions; and required clearances.
2. Modify manufacturer's standard schematic drawings and diagrams to supplement standard information and to provide information specifically applicable to the work. Delete information not applicable.
3. Stamp and sign each set of manufacturer's product data before submitting to Architect to certify compliance with Contract Documents.
4. Number of Copies Required: Submit two paper copies of Product Data, and in portable data file (.pdf) format, unless otherwise indicated. When submitting for Concurrent Consultant Review, submit two copies to Consultant and one copy to Architect. Architect will return one copy. Mark up and retain returned copy as a Project Record Document.
   a. Reproduction and cost of reproduction of processed Product Data for distribution to concerned parties is Contractor’s responsibility.

C. Shop Drawings

1. Reproduction of any portion of the Contract Documents for use as submittals for Shop Drawings is not acceptable.
2. Submit Shop Drawings in a clear and thorough manner.
   a. Title each drawing with Project name.
   b. Identify each element of drawings by reference to sheet number and detail, schedule, or room number of Contract Documents.
3. Identify the following:
   a. Requirements of the individual section of Project Manual.
   b. Field measurements.
   c. Field construction criteria.
   d. Relation to adjacent or critical features of the Work or products.
   e. Conformance of submittal with requirements of Contract Documents.
4. Each sheet of Shop Drawings shall be stamped and signed by Contractor before submitting to Architect. Certify compliance with requirements of Contract Documents.
5. Review by the Architect shall not relieve Contractor from his responsibility in preparing and submitting proper Shop Drawings in accordance with his

current obligations.

6. All submissions which, in the opinion of the Architect are incomplete, contain errors or have not been checked or only superficially checked, will be returned unchecked by the Architect for resubmission.
7. Fabrication of products or start of work before required Shop Drawings are reviewed by Architect and returned to Contractor shall be at Contractor's risk.
8. Number of Copies Required: Submit two paper copies of each submittal, and in portable data file (.pdf) format, unless indicated otherwise. When submitting for Concurrent Consultant Review, submit two copies to Consultant and one copy to Architect. Architect will return one copy. Mark up and retain one returned copy as a Project Record Drawing.
    a. Reproduction and cost of reproduction of processed Shop Drawings for distribution to concerned parties is Contractor’s responsibility.
    b. This procedure is to be followed for each submission of a drawing or group of drawings until they are finally reviewed by the Architect.

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

1. Transmit Samples that contain multiple, related components such as accessories together in one submittal package.
    a. Provide samples via postal or delivery service to Architect or appropriate consultant for review.
2. Identification: Attach label on unexposed side of Samples that includes the following:
    a. Generic description of Sample.
    b. Product name and name of manufacturer.
    c. Sample source.
    d. Number and title of appropriate Specification Section.
3. Disposition: Maintain sets of reviewed 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.

4. 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 Required: Submit two sets of Samples. Architect will retain one Sample set; the other will be returned.
   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 two sets of paired units that show approximate limits of variations.

E. Mock-Up Samples: Where samples are specified in the individual specification sections for use in constructing mock-ups, comply with requirements for "Office Samples", and process transmittal forms for mock-ups to provide a record of activity.

F. Submittals Schedule: Refer to project Construction Schedule.

1.05 INFORMATIONAL SUBMITTALS

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

1. Number of Copies: Submit one copy of each submittal, unless otherwise indicated. Architect will not return copy.
2. Certificates and Certifications: Provide a notarized 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.
3. Test and Inspection Reports.

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

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

D. Installer Certificates: Prepare 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.

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

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

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

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

I. Product Test Reports: Prepare written reports indicating 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.

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

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

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

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

M. Field Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.

N. Maintenance Data: Prepare written and graphic instructions and procedures for operation and normal maintenance of products and equipment.

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

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

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

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

1. Name, address, and telephone number of factory-authorized service representative making report.
2. Statement on condition of substrates and their acceptability for installation of product.
3. Statement that products at Project site comply with requirements.
4. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
5. Results of operational and other tests and a statement of whether observed performance complies with requirements.
6. Statement whether conditions, products, and installation will affect warranty.
7. Other required items indicated in individual Specification Sections.

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

S. Material Safety Data Sheets (MSDSs): Submit information directly to Owner; do not submit to Architect, except as required in "Action Submittals" Article. Retain copies at jobsite.

T. Coordination Drawings: Submit when applicable and as required.

1.06 DELEGATED DESIGN

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 Submittal: In addition to Shop Drawings, Product Data, and other required submittals, submit two copies of 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. When submitting for Concurrent Consultant Review, submit two copies to Consultant and one copy to Architect.

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

PART 2 PRODUCTS

Not Applicable

PART 3 EXECUTION

3.01 CONTRACTOR'S REVIEW

A. 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 Contractor Certification stamp before submitting to Architect.

3.02 ARCHITECT'S ACTION

A. General: Architect will not review submittals that do not bear the Contractor Certification stamp and will return them without action.

B. Action Submittals: Architect will review each submittal, make marks to indicate corrections or modifications required, and return it. Reference the General Conditions for Architect's review responsibilities. Review of a specific item does not indicate review of an assembly of which the item is a component. Architect will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action taken, as follows:

1. NO EXCEPTIONS TAKEN

2. REVISE AND RESUBMIT
3. FOR RECORD ONLY
4. MAKE CORRECTIONS NOTED
5. REJECTED
6. NOT REQUIRED FOR REVIEW.

C. 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.

D. Partial submittals are not acceptable, will be considered nonresponsive, and will be returned without review.

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

END OF SECTION

Submittal Review Cover

Moody Nolan

1. Contractor or Construction Manager

Submittal Number

Project

Project Number

Drawing Number and Specification Section

Manufacturer or Supplier

- ☐ **Calculations**
- ☐ **Certifications or Qualifications**
- ☐ **Coordination Drawing**
- ☐ **LEED Submittal**
- ☐ **Other:**
- ☐ **Product Data**
- ☐ **Samples** Copies: _____
- ☐ **Schedules**
- ☐ **Shop Drawings**

Item(s) Being Submitted

○ **Action** ○ **Information Only** ○ **Record**

Submitted For

○ **Low** ○ **Moderate** ○ **High** ○ **Critical**

Priority

Remarks or Deviations

Submitted By Date

Contractor Certification *Uncertified submittals will be returned without review.*

Reviewed By Date

2. Architect or Engineer

*To be filled **after** section above is completed.*

Date Received

Comments *See attached sheet(s) for additional comments.*

- ○ **No Exceptions Taken**
  No further review of submittal is required.
- ○ **Revise and Resubmit**
  Revise as noted; resubmit for review.
- ○ **For Record Only**
  For record or information purposes only.
- ○ **Make Corrections Noted**
  Incorporate corrections in work; resubmission is not required.
- ○ **Rejected**
  Submittal is not in compliance with Contract Documents.
- ○ **Not Required for Review**
  Submittal is not required by Contract Documents.

This review is for general conformance with the design concept and the contractor remains responsible for:

1. compliance with the contract documents
2. confirming and correlating quantities and dimensions
3. selecting fabrication processes and techniques of construction
4. coordination of the work with other trades
5. review of a specific item shall not indicate an approval of an assembly of which the item is a component

This review neither extends nor alters any contractual obligations of the architect or contractor, and does not authorize changes in the contract sum, nor time.

Reviewed By Date

Submittal Review Cover

Moody Nolan

2. Architect or Engineer

Additional Comments

Teamed Architect or Engineer Certification

SECTION 01 40 00

QUALITY REQUIREMENTS

PART 1 GENERAL

1.01 SUMMARY

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

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

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

1.02 RELATED SECTIONS

A. Cutting and Patching (for repair and restoration of construction disturbed by testing and inspecting activities): Section 01 73 29.

B. Specific test and inspection requirements: Divisions 02 through 49 Sections.

1.03 DEFINITIONS

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

B. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that completed construction complies with requirements. Services do not include contract enforcement activities performed by A/E.

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

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

E. Product Testing: Tests and inspections that are performed by an NRTL, an NVLAP, or a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with industry standards.

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

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

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

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

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

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

1.04 DELEGATED DESIGN

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 A/E.

1.05 CONFLICTING REQUIREMENTS

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

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

1.05 SUBMITTALS

A. Shop Drawings: For integrated exterior mockups, provide plans, sections, and elevations, indicating materials and size of mockup construction.

1. Indicate manufacturer and model number of individual components.
2. Provide axonometric drawings for conditions difficult to illustrate in two dimensions.

B. Delegated-Design Submittal: In addition to Shop Drawings, Product Data, and other required submittals, 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.

C. 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.

D. Reports: Prepare and submit certified written reports that include the following:

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

E. Permits, Licenses, and Certificates: For Owner's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence,

records, and similar documents, established for compliance with standards and regulations bearing on performance of the Work.

1.06 QUALITY ASSURANCE

A. General: 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.

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, 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 to those indicated for this Project in material, design, and extent.

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

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

G. Testing Agency Qualifications: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspecting indicated, as documented according to ASTM E 548; and with additional qualifications specified in individual Sections; and where required by authorities having jurisdiction, that is acceptable to authorities.

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

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

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

1. Contractor responsibilities include the following:
   a. Provide test specimens representative of proposed products and construction.
   b. Submit specimens in a timely manner with sufficient time for testing and analyzing results to prevent delaying the Work.
   c. Provide sizes and configurations of test assemblies, mockups, and laboratory mockups to adequately demonstrate capability of products to comply with performance requirements.
   d. Build site-assembled test assemblies and mockups using installers who will perform same tasks for Project.
   e. Build laboratory mockups at testing facility using personnel, products, and methods of construction indicated for the completed Work.
   f. When testing is complete, remove test specimens, assemblies, mockups, and laboratory mockups; do not reuse products on Project.
2. Testing Agency Responsibilities: Submit a certified written report of each test, inspection, and similar quality-assurance service to A/E, 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.

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

1. Build mockups in location and of size indicated or, if not indicated, as directed by A/E.
2. Notify A/E seven days in advance of dates and times when mockups will be constructed.
3. Demonstrate the proposed range of aesthetic effects and workmanship.
4. Obtain A/E's approval of mockups before starting work, fabrication, or construction.
   a. Allow seven days for initial review and each re-review of each mockup.
5. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
   a. Cover mock-ups to protect them from deterioration and weathering.
6. Demolish and remove mockups when directed, unless otherwise indicated.

1.07 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.
2. Payment for these services will be made by the Owner.
3. Costs for retesting and re-inspecting 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 quality-control services required of Contractor by authorities having jurisdiction, whether specified or not.

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. Where services are indicated as Contractor's responsibility, engage a qualified testing agency to perform these quality-control services.
   a. Contractor shall not employ same entity engaged by Owner, unless agreed to in writing by Owner.
3. Notify testing agencies at least 24 hours in advance of time when Work that requires testing or inspecting 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 inspecting 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. 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.

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

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

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

1. Notify A/E and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
2. Interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from requirements.
3. Testing agency will submit a certified written report of each test, inspection, and similar quality-control service to A/E, Engineer and Owner with copy to Contractor and to authorities having jurisdiction.
4. Do not release, revoke, alter, or increase requirements of the Contract Documents or approve or accept any portion of the Work.
5. Do not perform any duties of Contractor.

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

1. Access to the Work.
2. Incidental labor and facilities necessary to facilitate tests and inspections.
3. Adequate quantities of representative samples of materials that require testing and inspecting. Assist agency in obtaining samples.
4. Facilities for storage and field-curing of test samples.
5. 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 inspecting 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 inspecting.

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

1.08 SPECIAL TESTS AND INSPECTIONS

A. Special Tests and Inspections: Owner will engage a qualified testing agency to conduct special tests and inspections required by [OBC] [IBC] as the responsibility of the Owner, and as follows:

B. Special Tests and Inspections: Conducted by a qualified special inspector as required by authorities having jurisdiction, as indicated in individual Specification Sections, and as follows:

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

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

PART 2 PRODUCTS (Not Used)

PART 3 EXECUTION

3.01 TEST AND INSPECTION LOG

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

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

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

3.01 REPAIR AND PROTECTION

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

1. Comply with requirements of Section 01 73 29, Cutting and Patching.

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

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

END OF SECTION

SECTION 01 41 13

FIRE RESISTANCE RATINGS REQUIREMENTS

PART 1 GENERAL

1.01 SUMMARY

A. Requirements of this Section apply to the Work of all other Sections.

1.02 STANDARDS

A. Standards, codes and regulations published by Manufacturer's Associations, governmental agencies, referenced fire resistance rating and other regulatory authorities form a part of these Specifications as minimum requirements.

B. Where differences occur between the Contract Documents and such standards, the most restrictive requirement shall apply.

D. Supply all materials and perform all work in accordance with the fire rating assembly and installation procedures, and in conformance with published trade and manufacturer's association standards, unless specifically noted otherwise herein.

1.04 REFERENCES

A. American Society for Testing and Materials (ASTM)

B. National Fire Protection Association (NFPA)

C. Underwriters' Laboratories (UL)

PART 2 MATERIALS

2.01 MATERIALS AND PRODUCTS

A. See individual assembly specifications for materials and products used in fire ratings assembly.

B. References and standards listed in the individual fire rated assembly specification sections apply to the work of this section.

PART 3 EXECUTION

3.01 INSTALLATION

A. Refer to drawings for locations, extent and fire rated assembly to be used. See individual fire rating assembly specification sections for installation requirements and procedures of materials and products used.

B. General: Use materials, fabrication, construction personnel and installation methods identical with those indicated and planned for the final Work.

END OF SECTION

SECTION 01 45 33

SPECIAL INSPECTIONS AND STRUCTURAL TESTS

PART 1 GENERAL

1.01 GENERAL REQUIREMENTS

A. Special Inspections and Structural Testing shall be in accordance with Chapter 17 of the Ohio Building Code.

B. The program of Special Inspection and Structural Testing is a Quality Assurance program intended to ensure that the work is performed in accordance with the Contract Documents.

C. This specification section is intended to inform the Contractor of the Owner's quality assurance program and the extent of the Contractor's responsibilities. This specification section is also intended to notify the Special Inspector, Testing Laboratory and other Agents of the Special Inspector of their requirements and responsibilities.

1.02 CONTRACTOR RESPONSIBILITIES

A. The Contractor shall cooperate with the Special Inspector and his agents so that the special inspections and testing may be performed without hindrance.

B. The Contractor shall be responsible for coordinating and scheduling inspections and tests. The Contractor shall notify the Special Inspector or Testing Laboratory at least 24 hours in advance of a required inspection or test. Uninspected work that required inspection may be rejected solely on that basis.

C. The Contractor shall provide incidental labor and facilities to provide access to the work to be inspected or tested,, to obtain and handle samples at the site or at source of products to be tested, to facilitate tests and inspections, storage and curing of test samples.

D. The Contractor shall keep at the project site the latest set of construction drawings, field sketches, approved shop drawings, and specifications for use by the inspectors and testing technicians.

E. The Special Inspection program shall in no way relieve the Contractor of his obligation to perform work in accordance with the requirements of the Contract Documents or from implementing an effective Quality Control program.

All work that is to be subjected to Special Inspections shall first be reviewed by the Contractor's quality control personnel.

F. The Contractor shall be solely responsible for construction site safety.

1.03 LIMITS OF AUTHORITY

A. The Special Inspector or Testing Laboratory may not release, revoke, alter, or enlarge on the requirements of the Contract Documents.

B. The Special Inspector or Testing Laboratory will not have control nor responsibility over the Contractor's means and methods of construction.

C. The Special Inspector or Testing Laboratory shall not be responsible for construction site safety.

D. The Special Inspector or Testing Laboratory has no authority to stop the work.

1.04 STATEMENT OF SPECIAL INSPECTIONS

A. Statement of Special Inspections is attached following this section, for reference.

END OF SECTION

Scott Messer
Director

THE CITY OF
COLUMBUS
ANDREW J. GINTHER, MAYOR

DEPARTMENT OF BUILDING
AND ZONING SERVICES

STATEMENT OF SPECIAL INSPECTIONS

PROJECT LOCATION (PRINT) _SCARBOROUGH SENIOR HOUSING_____

PERMIT APPLICATION NUMBER (PRINT) _____

This statement of special inspections shall be submitted as a condition of plan approval and permit issuance.

- Part 1: A complete list of work requiring special inspections and the frequency of inspections as required by the Ohio Building Code (Chapter 17.)
- Part II: A list of approved special inspectors from the list of Special Inspection Testing Agencies and Inspectors published on the City of Columbus Department of Building and Zoning Services website. The special inspectors shall be employed by the owner or by the registered design professional in responsible charge acting as the owner's agent. Submit proper resumes and/or certificates of the special inspectors.

Part 1: SCHEDULE OF SPECIAL INSPECTIONS				
	Required	Continuous Inspection	Periodic Inspection	Scope
Special Cases: 1705.1.1				
• Alternative systems				
• Unusual design applications				
• Additional manufacturer's instructions/requirements				
Steel Construction: 1705.2				
• Structural steel	X	X		**SEE S002**
• Cold-formed steel deck				
• Open web steel joists deck				
• Cold formed steel trusses over 60' in span				

Part 1: SCHEDULE OF SPECIAL INSPECTIONS- Continued				
	Required	**Continuous Inspection**	**Periodic Inspection**	**Scope**
Concrete Construction: 1705.3	X			**SEE S002**
• Reinforcing steel placement	X		X	
• Reinforcing steel welding	X	X		
• Anchors cast in concrete	X		X	
• Anchors in hardened concrete	X	X		
• Design mix	X		X	
• On site fresh concrete testing	X	X		
• Concrete and shotcrete application techniques	X	X		
• Concrete curing	X		X	
• Pre-stressed concrete				
• Pre-cast concrete				
• In-situ concrete tests				
• Formwork dimensions	X		X	
Masonry Construction: 1705.4	X			**SEE S002**
• Masonry, glass unit masonry and masonry veneer in risk category IV				
• Vertical masonry foundation elements	X		X	
Wood Construction: 1705.5	X		X	**SEE S002**
• Prefabricated wood structural elements				
• High-load diaphragms				
• Metal-plate-connected wood trusses spanning 60’ or greater				

Part 1: SCHEDULE OF SPECIAL INSPECTIONS- Continued				
	Required	Continuous Inspection	Periodic Inspection	Scope
Soils: 1705.6	X			**SEE S002**
• Shallow foundation design bearing capacity	X		X	
• Proper depth	X		X	
• Compacted fill materials classification and testing	X		X	
• Compacted fill materials, density and lift thickness	X	X		
• Subgrade and site prep prior to fill placement	X		X	
Driven Deep Foundations: 1705.7				
Cast-in-Place Deep Foundations: 1705.8				
Helical Pile Foundations: 1705.9				
Fabricated Items: 1705.10				
Wind Resistance: 1705.11				
• Structural wood				
• Cold-formed steel light framed construction				
• Wind-resisting components				
Seismic Resistance: 1705.12				
• Structural steel				
• Structural wood				
• Cold-formed steel light framed construction				
• Designated seismic systems				
• Architectural components				
• M.E.P. components				
• Storage racks				

Part 1: SCHEDULE OF SPECIAL INSPECTIONS- Continued				
	Required	Continuous Inspection	Periodic Inspection	Scope
• Seismic isolation systems				
• Cold-formed steel special bolted moment frames				
Testing of Seismic Resistance: 1705.12.9				
• Structural steel				
• Non-structural components				
• Designated seismic systems				
• Seismic isolation systems				
Sprayed Fire-Resistant Materials: 1705.14				
• Condition of substrates				
• Thickness of application				
• Density				
• Bonding strength				
• Finished application				
Mastic and Intumescent Fire-Resistant Coatings: 1705.15				
Exterior insulation and finish system (E.I.F.S.): 1705.16				
Water-resistive barrier coating: 1705.16.1				
Fire-Resistant Penetrations And Joints: 1705.17				
• Penetration firestops			X	SEE G020
• Fire-resistant joint systems			X	SEE G020
Smoke Control Systems: 1705.18				
• Ductwork leakage testing prior to concealment				
• System testing and operation				

PART II: LIST OF SPECIAL INSPECTORS

- Special inspectors as identified on the list of Special Inspection Testing Agencies and Inspectors published on the City of Columbus Department of Building and Zoning Services website.

Inspection type	Inspection Company	Name of Inspector
Special cases		
Steel construction		
Concrete construction		
Masonry construction		
Wood construction		
Soils		
Deep driven foundations		
Cast-in-place deep foundations		
Helical Pile Foundations		
Fabricated items		
Wind resistance		
Seismic resistance		
Testing for seismic resistance		
Sprayed fire-resistant Materials		
Mastic and Intumescent Fire-Resistant Coatings		
Exterior Insulation and Finish Systems (E.I.F.S.)		
Water-resistive barrier coating		
Fire-resistant penetrations and joints		
Smoke control		

The preceding statements of special inspections (Parts I and II) have been prepared in accordance with the provision of Section 1704.3 of the Ohio Building Code.

The project registered design professional in responsible charge acknowledges that he or she is responsible for reviewing and approving the special inspection reports submitted by the special inspectors at the required inspection periods. Any discrepancies in special inspection reports shall be brought to the attention of the building official. A final special inspection report documenting required special inspections and corrections of any discrepancies noted in the inspections shall be submitted to the building official.

Project Registered Design Professional in Responsible Charge:

Name of Designer: _____

Ohio Registration No: _____

Name of Company: _____

Signature: _____ Date: _____

Property Owner:

Name of Owner: _____

Name of Company: _____

Signature: _____ Date: _____

FINAL REPORT FOR SPECIAL INSPECTIONS

To be completed after special inspections have been performed

Application No: _____

Project Name: _____

Project Location: _____

Pursuant to Section 1704.2.4 Ohio Building Code, Special Inspectors shall keep records of inspections and furnish inspection reports to the building official, and to the registered design professional in responsible charge. Reports shall indicate that work inspected was done in conformance with the approved construction documents. Discrepancies shall be brought to the immediate attention of the contractor for corrections. If discrepancies are not corrected, the discrepancies shall be brought to the attention of the building official and to the registered design professional in responsible charge prior to the completion of that phase of the work. This report requires the inspectors to note the date of when the respective work received final inspection and approval, any special conditions or limitations of the approval, and the inspector's name.

FINAL APPROVAL OF WORK – CONDITIONS				
No.	ITEM	DATE	CONDITION/LIMITATIONS	NAME OF INSPECTOR
1	Special cases			
2	Steel construction			
3	Concrete construction			
4	Masonry construction			
5	Wood construction			
6	Soils			
7	Deep driven foundations			
8	Cast-in-place deep foundations			
9	Helical pile foundation			
10	Fabricated items			
11	Wind resistance			
12	Seismic resistance			
13	Testing for seismic resistance			

14	Sprayed fire-resistant materials			
15	Mastic and intumescent fire-resistant Coatings			
16	Exterior Insulation and Finish System (E.I.F.S.)			
17	Water-resistive barrier coating			
18	Fire-resistant penetrations and joints			
19	Smoke control			

The project registered design professional in responsible charge also acknowledges that he/she has reviewed and approved the special inspection reports submitted by the special inspectors at the required inspection periods. Any discrepancies in special inspection reports have been brought to the attention of the building official. A final special inspection report documenting required special inspections and corrections of any discrepancies noted in the inspections have been submitted to the building official.

Project Registered Design Professional in Responsible Charge:

Name of Designer: _____

Ohio Registration No: _____

Name of Company: _____

Signature: _____ Date: _____

Property Owner:

Name of Owner: _____

Name of Company: _____

Signature: _____ Date: _____

SECTION 01 50 00

TEMPORARY FACILITIES AND CONTROLS

1.01 GENERAL

A. Any Contractor requiring one of the temporary services before it can be provided as specified, or whose requirements with respect to a particular service differ from the service specified, shall provide such service as suits their needs, at their own expense and in a manner satisfactory to the Architect.

B. This Section is not intended to limit types and amounts of temporary construction facilities and controls required. Omission from this Section will not be accepted as an application that such temporary activity is not required for successful completion of the work and compliance with requirements of the Contract Documents.

C. Provide and maintain each temporary construction facility and control when required for proper performance of the work. Provide maintenance personnel to perform this work in accordance with the requirements. Terminate and remove when no longer needed or when permanent facilities, with proper authorization, are available for use.

1. Maintenance time will include normal working hours for all trades and start up and shut down overtime as required.

D. Obtain and pay for all required applications, fees, permits and inspections required for temporary construction facilities and controls.

E. Install, operate, maintain and protect temporary construction facilities and controls in a manner and at locations which are safe, non-hazardous, sanitary and adequately protect project work, workmen and the public.

1.02 CONTRACTOR RESPONSIBILITIES

A General Contractor: Responsible for the following:

1. Maintaining toilets and sanitary facilities, including disposable supplies.
2. Temporary enclosure of building.
3. General hoisting facilities (up to 2 ton loading) as required. See Article 1.11 for payment.
4. Temporary signs.
5. General collection and disposal of wastes and daily clean-up.
6. Construction aids and miscellaneous services and facilities.
7. Sidewalk canopies, barriers and fence.
8. Environmental protection containment of dust and debris fumes.

D. Plumbing Contractor: Responsible for the following:

1. Temporary fire hoses and fire hose signs.
2. Temporary water distribution [from existing building source] [from main].
3. Clean-up of their own work and disposal of debris to central collection areas provided by General Trades Contractor.
4. Maintain operation of toilet fixtures and piping in first class working condition and turn over to Owner in same first class condition.

E. HVAC Contractor: Responsible for the following:

1. Temporary heating system and servicing of permanent heating system when used for temporary heating during construction.
2. Temporary ventilation system.
3. Temporary operation of air conditioning system for humidity control.
4. Clean-up of their own work and disposal of debris to central collection areas provided by General Trades Contractor.

F. Electrical Contractor: Responsible for the following:

1. Temporary electric power distribution from existing building source.
2. Temporary lighting.
3. Clean-up of their own work and disposal of debris to central collection areas provided by General Trades Contractor.

1.03 COST OF CONSUMED UTILITIES

A. Water Service Use Charges: Water consumed during construction is to be metered. Cost of water consumed during construction will be paid for by the General Contractor.

B. Electric Power Service Use Charge: Cost of electric power consumed during construction is to be metered. Cost of electric power consumed during construction will be paid for by the General Contractor.

C. Sewer Service Use Charges: The cost of providing portable toilets will be paid by the General Contractor. Where existing building toilet facilities are used, there will be no charge for sewer usage by all entities authorized to be at or to perform work at the project site.

D. Propane for Temporary Heat

1. Prior to the structure being permanently enclosed: Paid for by the contractor requiring the temporary heat.
2. After structure is permanently enclosed: Paid for by the General Contractor.

1.04 REQUIREMENTS OF REGULATORY AGENCIES

A. Provide and maintain all temporary facilities in compliance with governing rules, regulations, codes, ordinances and laws of agencies and utility companies having jurisdiction over work involved in project.

B. Be responsible for all temporary work provided, and obtain any necessary permits and inspections for such work.

C. Contractors shall confine equipment, storage of materials, and operation of workmen to the limits indicated or directed and shall abide by law, ordinances, conditions stated in permits and directions of the Architect.

D. Do not interfere with normal use of roads in vicinity of project site except as indicated or as absolutely necessary to execute required work, and then only after proper arrangements have been made with authorities having jurisdiction, including traffic control as applicable.

1.05 SPECIAL PRECAUTIONS AND REQUIREMENTS

A. Do not interfere with normal use of occupied areas in existing buildings, existing driveway access to existing building and existing building utility services, except as absolutely necessary to execute required work involving such facilities, and then only after proper arrangements have been made through the Owner with persons in charge of existing facilities.

B. Do not block required exits from existing buildings.

1.06 TEMPORARY FIELD OFFICES AND TRAILERS

A. General Contractor: Provide and maintain clean weather tight offices at the site for his use, his Subcontractor's Agents and the Architect and at which location he or his authorized agent shall be present, or to which either may be readily called at all times while the work is in progress. Copies of permits, approved shop drawings, plans and specifications marked up-to-date with all revisions and all addenda shall be kept at said office ready for use at all times.

1. Provide field office heated and lighted. All expenses in connection with the field office, including the installation cost and use of heat, air conditioning, light, water and janitor service shall be borne by the General Contractor.

B. Copies of permits, approved shop drawings, plans and specifications marked up-to-date with all revisions and all addenda shall be kept at said offices areas ready for use at all times.

C. All expenses in connection with Contractors' field offices, including the installation cost and use of telephones, shall be borne by the specific Contractor.

D. Maintain field office areas until final acceptance and then remove, unless the Architect orders or approves earlier removal.

E. All costs, including utility installation costs to the field office is the responsibility of each Contractor.

F. Each Contractor shall provide and maintain such additional storage trailers on the project as required for their own use.

G. Final location of all field offices areas and trailers shall be as directed by Architect.

1. Contractors may be required to relocate their offices, as directed by Architect, during construction as work progresses.

1.07 TEMPORARY SANITARY FACILITIES

A. General Contractor: Provide temporary portable toilets, acceptable to public health authorities, as required to service the project. Maintain in a clean, sanitary condition.

1.08 TEMPORARY WATER SERVICE

A. General: Water is available from water main indicated on site drawings.

B. Plumbing Contractor

1. Arrange for, provide and pay for temporary water connections to water main, installation of metered extension and suitable fixtures at termination of lines.
2. Provide sufficient branch lines of adequate size to serve the needs of all trades. Locate water supplies at convenient locations, as directed by Architect.
3. Provide insulated housings for temporary service lines to protect against freezing, when applicable.

C. Each Contractor is responsible for dispensing water from source furnished by Plumbing Contractor.

1.09 TEMPORARY HEAT AND VENTILATION

A. Each Contractor: Prior to permanent enclosure of the structure, provide temporary heat as necessary to complete the work.

1. Provide weather protection as required to carry on work during inclement weather and to protect work and materials from damage by weather.
2. Protection of work includes covering, temporary enclosures, heating materials and work under construction and for providing suitable working conditions.
3. Furnish temporary heat by Owner approved types of units or equipment which is safe, will not affect surrounding areas of Contract Work and is properly supervised while in use.

B. "Permanently enclosed" shall mean that permanent walls and roofs are in place and weather tight, windows are in place and glazed and all entrance enclosures are either permanently in place or provided with suitable temporary enclosures.

1. Polyethylene sheet is not considered a suitable temporary enclosure. One-half inch thick plywood tightly fit, sealed and supported and maintained can be considered a temporary enclosure.

C. HVAC Contractor: After the structure is permanently enclosed, provide, operate and maintain until substantial completion, approved temporary heating, ventilating and humidity control units to maintain that portion of the structure at suitable temperature and humidity conditions to complete the work.

1. Arrange temporary units to bring in sufficient outdoor air to ventilate the structure and to prevent build-up of harmful dusts and fumes and to remove excess moisture. During warm weather, provide an adequate supply of fresh air, when necessary, to properly ventilate moisture, dust, fumes from paints, cements or adhesives in tightly-enclosed areas where natural ventilation will not be sufficient.
2. Provide temporary heating and ventilating to service the project. As a minimum, provide the following:
   a. During normal working hours, minimum 50° F.
   b. During placing, setting and curing of concrete, minimum 50° F.
   c. For 10 days prior to placing interior finish materials and throughout interior finishing, painting, etc., and until final acceptance of work and occupancy by Owner, minimum 70° F.
   d. Supply heat and ventilation in a manner which avoids rapid drying of material but permits material and building to dry so remaining moisture will not affect finish material.
   e. Operate temporary systems each day, including Saturdays, Sundays and holidays. Include necessary labor and approved operating personnel.
   f. Supply all fuel required for temporary heating and ventilating, including all material, labor and supervision to connect same.
   g. Select equipment that will not have a harmful effect on completed installations or elements being installed. Coordinate ventilation requirements to produce ambient condition required and minimize energy consumption.
3. Isolation of Work Areas in Occupied Facilities: Prevent dust, fumes, and odors from entering occupied areas.
   a. Prior to commencing work, isolate the HVAC system in area where work is to be performed in accordance with approved coordination drawings.
      1) Disconnect supply and return ductwork in work area from HVAC systems servicing occupied areas.
      2) 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.

b. 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.
c. Perform daily construction cleanup and final cleanup using approved, HEPA filter-equipped vacuum equipment.

D. When permanent systems are used for temporary construction use, HVAC Contractor shall assume full responsibility for maintaining such equipment during and after use. Included in maintenance are the following:

1. Proper operation and maintenance of the mechanical equipment until acceptance of the project by Owner.
2. Maintenance of temporary filters in all equipment to prevent accumulation of dust and dirt in coils, housings and ductwork.
3. Prior to final inspection; replacement of temporary filters with new filters, thorough cleaning of coils and other equipment, putting entire system into first class condition, cleaning traps and devices, adjustment and removal of any and all materials and equipment not functioning properly.
4. Owner and Architect must be given access to and opportunity to inspect equipment and maintenance procedures at all times. Owner involvement will not relieve the HVAC Contractor from the responsibilities specified herein.

E. Use of permanent heating or cooling and ventilating equipment for temporary construction use shall not effect warranty. Warranty shall take effect at time of project acceptance by Owner.

F. Cost of Temporary Heat: Cost of fuel consumed in conjunction with temporary heat or permanent system used for temporary heat shall be paid by the General Contractor. However, the cost of temporary heat prior to the building being permanently enclosed shall be paid by the Contractor requiring same.

1. Electric resistance type heating units are not permitted.

G. During periods of extremely low temperatures when water pipes could possibly freeze or when such conditions are forecast, temporary heating must be monitored 24-hours a day, 7 days a week.

1.10 TEMPORARY LIGHT AND POWER

A. Electrical Contractor

1. Provide necessary temporary electrical service and temporary wiring and outlets as required to meet project needs for temporary lighting and power at the start of the project, as work progresses and until acceptance by the Owner, excluding power to individual contractor's trailers.
2. Extend temporary service from existing building service. Size system to adequately service project.
3. Construct temporary pole line as required.

4. Remove temporary service, light and power system when permanent services and systems are available for use. No temporary system component shall form a part of the permanent systems.
5. Electrical work for construction purposes shall conform to Federal, State and local safety requirements, as well as requirements of the National Electrical Code. Obtain and pay for required applications, permits and inspections pertaining to this work.
6. Install temporary lighting and receptacle circuits along a route least objectionable to the construction work, coordinate with the Architect.
7. Provide all lamps; quantity and size to service the project. Replace lamps and fuses throughout the life of the project.
8. Pay all costs for installation, maintenance, supervision and removal of temporary light and power systems.
9. Make connections for temporary heat. Check temporary heat requirements.

B. Premium pay for the temporary power electrician shall be negotiated between the Contractors on the job requiring overtime service. If an electrician is required on the project before total work is started, pay for temporary power electrician shall be negotiated between Contractors on the job requiring this service.

C. Temporary Lighting: Electrical Contractor size and layout as required to service the project.

1.11 CONSTRUCTION AIDS

A. Hoists and Cranes: Erect and maintain adequate hoisting facilities as required for the work.

B. Shoring and Bracing: [Each Contractor -]Provide all shoring and bracing required for safety and proper execution of their work. Remove these items when the work is completed.

C. Temporary Partitions and Closures: General Contractor
1. Provide temporary dustproof, security partitions in corridors, door openings and wall openings separating new work from existing building.
2. Provide weatherproof barriers and closures at all exterior openings prior to final doors, windows, louvers or similar type items being installed.
3. Construction methods and materials shall be approved by Architect prior to construction of partition, barrier or closure. However, construction shall be similar to plywood sheathing over wood studs with 6 mil plastic film applied over sheathing sealing all joints. Seal partitions at floor, walls and ceilings (roof).
   a. Fire-Rated Construction: Where required, provide fire-rated materials to meet rated conditions of existing wall.
4. Provide doors through temporary partitions with self closing devices and locks.

1.12 WEATHER PROTECTION

A. Protect work and existing or adjacent property against weather, to maintain work, materials, apparatus and fixtures free from injury or damage during the entire construction period. Work likely to be damaged shall be covered or protected at the end of each day's work. Any work damaged by failure to provide protection required, shall be removed and replaced with new work at the Contractor's expense.

B. General Contractor: Remove all snow and ice as may be required for proper protection and execution of the work and protection and safety of the public.

C. Winter weather closures and temporary doors at all unclosed openings will be provided by the General Contractor.

1.13 WATCHMAN SERVICE

A. If Contractors consider watchman services necessary or desirable for protection of their own interest, they may employ such service at their own complete expense.

1.14 SAFETY

A. Safety requirements shall be in accordance with the General Conditions.

B. The responsible Contractor shall provide and maintain guard lights at all barricades, railings, obstructions in the roadways or sidewalks and at all trenches or pits adjacent to walks or roadways.

C. Strict attention and full adherence must be given the Williams - Steiger Occupational Safety and Health Act of 1970, U.S. Department of Labor.

1.15 SECURITY CONDITIONS

A. Security of building must be maintained during "non-standard" working hours (premium time). This includes, but is not necessarily limited to, verifying all entrance doors and windows are secured.

B. Each Contractor shall be responsible for all infractions of rules and regulations by his workers.

C. Loitering or wandering through the corridors and into rooms not connected with the project or into other buildings on campus will not be permitted.

D. General Contractor: Erect a 6 foot high fence with gates to enclose construction site.

1. Material: Heavy chain link mesh with steel posts.
2. Location: Around entire perimeter of the site.
3. Provide metal gates, of same fabric as metal fence, where indicated.
4. Maintain fence and gates in working order at all times.
5. Except during working hours, keep gates locked at all times.

1.16 DUST CONTROL

A. Control dust originating within project limits using water or a dust palliative acceptable to the Architect. When conditions create blowing dust and dirt that is considered higher than that normally encountered, cooperate with Architect in determining methods to help minimize blowing. This may involve, as a minimum, more frequent applications of dust palliative. Calcium chloride may not be used.

1.17 TEMPORARY SIGNS

A. Temporary Project Sign

1. Provide project sign approximately 4 feet by 8 feet.
2. Painting by professional sign painter, with text, design, layout and colors as directed by Architect.
3. Materials: 3/4" APA-AB-EXT. Plywood for sign face with pine or fir trim. Provide 4 x 4 treated wood posts of sufficient length and quantity to securely brace and support sign against wind pressure.
4. Locate sign as directed by Architect. Maintain until completion of project, then remove. Erect sign a minimum of 8 feet from public right of way.

B. Temporary Directional Signs: Provide as required to adequately direct traffic and personnel on site.

1.19 STREETS AND TRAFFIC

A. Cleaning and Repair

1. Remove mud and spillage from public walks, streets and sewers without delay. Failure to clean areas promptly will result in areas being cleaned by the Owner at the responsible Contractor's expense.
2. Damage to roads or other facilities on the grounds, resulting from hauling, storage of materials, or other activities in connection with the work shall be repaired or replaced, at no expense to the Owner, by the Contractor causing the damage. Repairs or replacements shall be made to the satisfaction of the Architect.

B. Traffic

1. Notify local law enforcement agency at least two weeks in advance of any anticipated work affecting traffic flow.
   a. To assure maintenance of flow and to safeguard all parties involved in planning to maintain flow, a field inspection should be made jointly by the Architect and Contractor personnel before performing any work which would interrupt normal traffic patterns.
   b. Re-routing of traffic shall be planned, as to route and direction, in cooperation with the local law enforcement agency.

1.20 PARKING

A. Employees of Contractors and subcontractors must park vehicles in areas assigned to them. Parking on streets or in restricted areas is prohibited.

1.21 CONSTRUCTION LAYOUT AND FIELD ENGINEERING

A. General

1. General Contractor
   a. Employ a registered surveyor.
   b. Layout all walls and partitions on concrete slabs from which other trades are to locate their work. This does not relieve other trades from responsibilty of locating and coordinating their work.

B. Verification: Before proceeding to lay out the Work, verify layout information shown on Drawings, in relation to the property survey and existing benchmarks. If discrepancies are discovered, notify Architect promptly.

C. General: Surveyor, registered in the State of **Ohio** to lay out the building on the site and to locate and fix all site items such as site improvements and utilities and furnish a certified plat of this work. Work includes:

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 dimensions within tolerances indicated. Do not scale Drawings to obtain required dimensions.
3. Inform installers of lines and levels to which they must comply.
4. Check the location, level and plumb, of every major element as the Work progresses.
5. Notify Architect when deviations from required lines and levels exceed allowable tolerances.
6. Close site surveys with an error of closure equal to or less than the standard established by authorities having jurisdiction.

D. Site Improvements: Locate and lay out site improvements, including pavements, grading, fill and topsoil placement, utility slopes, and rim and invert elevations.

E. 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.

F. 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.

G. Field Engineering

1. 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.
   a. 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.
   b. Replace lost or destroyed permanent benchmarks and control points promptly. Base replacements on the original survey control points.
2. 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.
   a. Record benchmark locations, with horizontal and vertical data, on Project Record Documents.
   b. 2. Where the actual location or elevation of layout points cannot be marked, provide temporary reference points sufficient to locate the Work.
   c. Remove temporary reference points when no longer needed. Restore marked construction to its original condition.
3. 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.
4. Final Property Survey: Surveyor to prepare a final property survey showing significant features (real property) for Project. Include on the survey a certification, signed by land surveyor, that principal metes, bounds, lines, and levels of Project are accurately positioned as shown on the survey.
   a. 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.
   b. Recording: At Substantial Completion, have the final property survey recorded by or with authorities having jurisdiction as the official "property survey."

END OF SECTION

SECTION 01 60 00

PRODUCT REQUIREMENTS

PART 1 GENERAL

1.01 SUMMARY

A. Requirements of this Section apply to the Work of all other Sections.

B. Section Includes:

1. Transportation and Handling.
2. Storage and Protection.
3. Standards.
4. Manufacturers and Types.
5. Fabrications.
6. Shop Priming.
7. Prohibited Materials and Methods.

1.02 RELATED SECTIONS

A. Quality Requirements: Section 01 40 00.

B. Cutting and Patching: Section 01 73 29.

C. Shop Drawings, Product Data and Samples: Section 01 33 23.

D. Execution Requirements: Section 01 73 00.

1.03 STANDARDS

A. Standards, codes and regulations published by Manufacturer's Associations, governmental agencies and other regulatory authorities form a part of these Specifications as minimum requirements. Such references include the latest issue and all amendments up to 30 days prior to the Bid Date.

B. "Governing Authority" means all federal, state and local laws and regulations.

C. Where differences occur between the Contract Documents and such standards, the most restrictive requirement shall apply.

D. Supply all materials and perform all work in accordance with the Manufacturer's Specifications and installation procedures, and in conformance with published trade and manufacturer's association standards, unless specifically noted otherwise herein.

1.04 TRANSPORTATION AND HANDLING

A. Arrange deliveries of products in accordance with construction schedules and installation, coordinate to avoid conflict with work and conditions at the site.

1. Transport products by methods to avoid product damage.
2. Deliver products in undamaged condition, in manufacturer's original containers or packaging, with identifying labels intact and legible.
3. Immediately on delivery, inspect shipments to assure compliance with requirements of Contract Documents and accepted submittals, and that products are properly protected and undamaged.

B. Provide equipment and personnel to handle products by methods to prevent soiling or damage.

1.05 DELIVERY, HANDLING, STORAGE AND PROTECTION

A. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft and vandalism. Comply with manufacturer's written instructions.

B. Delivery and Handling

1. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.
2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
3. Deliver products to Project site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
4. Inspect products on delivery to determine compliance with the Contract Documents and to determine that products are undamaged and properly protected. Reject damaged and defective items.

B. Storage products in accordance with manufacturer's instructions.

1. Store products with seals and labels intact and legible.
2. Store products to allow for inspection and measurement of quantity or counting of units.
3. Store products subject to damage by the elements in weathertight enclosures.
4. Maintain temperature and humidity within the ranges required by manufacturer's instructions.
5. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.

C. Exterior Storage

1. Store fabricated products above the ground, on blocking or skids, to prevent soiling or staining. Cover products which are subject to deterioration with impervious coverings. Provide adequate ventilation to avoid condensation.
2. Store loose granular materials in a well-drained area on solid surfaces to prevent mixing with foreign materials.
3. Store foam plastic away from exposure to sunlight, except to extent necessary for period of installation and concealment.

D. Arrange storage in a manner to provide access for inspection. Make periodic inspections of stored products to assure that products are maintained under specified conditions, and free from damage.

E. Protection After Installation: Provide coverings as necessary to protect installed products from damage from traffic and subsequent construction operations. Remove when no longer needed.

PART 2 PRODUCTS

2.01 GENERAL PRODUCT REQUIREMENTS

A. Products include materials, equipment and systems.

B. Products incorporated into the work:

1. Comply with specifications and referenced standards as minimum requirements.
2. Undamaged.
2. Manufactured and fabricated products:
   a. Design, fabricate and assemble in accordance with the best engineering and shop practices.
   b. Manufacture like parts of duplicate units to standard sizes and gages, to be interchangeable.
   c. Two or more items of the same kind shall be identical, by the same manufacturer.
   d. Products shall be suitable for service conditions.
   e. Equipment capacities, sizes and dimensions shown or specified shall be adhered to unless variations are specifically approved in writing by the Architect.
4. Do not use material or equipment for any purpose other than that for which it is designed or is specified.
5. New and unused at time of installation, except as otherwise indicated.
6. 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.

7. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.

2.02 MANUFACTURER AND PRODUCT SELECTION PROCEDURES

A. Specified Product: Where specifications name a single manufacturer and product or refer to a single manufacturer and product indicated on the drawings, provide the named product. Comparable products or substitutions for Contractor's convenience will not be considered.

B. Specified Manufacturer: 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.

C. Multiple Specified Products: Where more than one manufacturer and specific product is listed, provide one of the products named. No substitutions will be permitted after signing the contract. Comparable products or substitutions for Contractor's convenience will not be considered

D. Multiple 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.

E. Basis of Design: Where specifications name a Basis of Design or refer to a Basis of Design product indicated on the drawings, the design is based on the product listed. Subject to compliance with requirements, provide the specified product or a product manufactured by one of the other manufacturers listed.

1. The characteristics of the Basis-of-Design Product establish the significant qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics for purposes of evaluating comparable products of additional manufacturers named in the specification.
2. Equipment or materials from these manufacturers will be acceptable contingent upon their meeting the design, appearance and functional standards established by the specified items. If equipment or a material of an acceptable manufacturer requires changes; electrically, mechanically, structurally, from what is indicated on the drawings, it shall be the responsibility of the Contractor requiring such change, to pay all costs involved with no additional costs to the Owner.
3. Submit evaluations as follows:
    a. Submit proposed comparable products for evaluation by the Architect at least two weeks prior to awarding contract to the manufacturer of a comparable product.
    b. Obtain samples of Basis-of-Design product.

c. Select comparable products that comply with the characteristics specified. Submit evidence demonstrating compliance.

d. Submit samples of comparable products displayed side-by-side with samples of Basis-of-Design products.

Architect will determine whether the proposed comparable product is acceptable. Architect is not obligated to prove non-equivalence of proposed comparable products.

F. Where a performance is specified and no manufacturer is listed, submit through the Shop Drawing procedure the name of the manufacturer, the product proposed, and detailed information showing its characteristics. Such proposal shall meet or exceed the specification, line item by line item, or be rejected.

G. Equivalent components (articles, devices, materials, forms of construction, fixtures, etc.) may be submitted to the Architect for approval prior to bidding regardless of listed manufacturers.

H. Where Specifications include the phrase "as selected by Architect from manufacturer's full range" or similar phrase, select a product that complies with requirements. Architect will select color, gloss, pattern, density, or texture from manufacturer's product line that includes both standard and premium items.

2.03 CONFLICTING REQUIREMENTS

A. Documents: If documents state different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer uncertainties and requirements that are different, but apparently equal, to A/E for a decision before proceeding.

2.04 FABRICATION

A. Fabricate all items in the shop insofar as practicable. Where items cannot be completely shop fabricated and assembled for shipment, assemble and fit in shop, disassemble and ship. Identify parts for field assembly.

B. Fabricate items to be straight, square, in proper alignment, and with hairline joints where joints are necessary and permitted. Pre-plan field joints to be as inconspicuous as possible; coordinate locations with Architect.

2.05 SHOP PRIMING

A. Shop prime or seal surfaces of all products to receive paint materials in accordance with the requirements of Section 09 91 00.

B. Apply a primer or sealer compatible with the specified paint materials.

C. In the event such a primer is determined to be incompatible with the specified finish paint system, provide a barrier coat or remove the primer and reprime as

directed, at no additional cost to the Owner.

2.06 PROHIBITED MATERIALS AND METHODS

A. The following items are expressly prohibited:

1. Attachment Related Items
   a. Powder Fasteners: Powder fasteners are defined as anchors which are driven into place by any device which produces an impact force by use of a powder charge, compressed air, gas or any other propellent. Powder fasteners prohibited for the following conditions:
      1) Attachment of structural members.
      2) Where public may be endangered by misuse.
   b. Plug anchorage by use of wood, lead or plastic.
   c. Perforated steel strap iron for pipe or other support or anchorage.
   d. Suspension systems that are not independently supported.
      1) Ceiling grid systems shall not be supported from ductwork, electrical conduit, heating or plumbing lines, and vice versa.
      2) Each utility system and the ceiling system shall be a separate installation, each independently supported from the building structure.
      3) Where interference occurs, provide trapeze type hangers or other suitable supports for each system.
      4) Locate hangers and supports where they will not interfere with access to mixing boxes, fire dampers, valves, and other appurtenances requiring servicing.
2. Methods Related Items
   a. The penetration of floors and walls by pipes, ducts, or other penetrations unless openings are appropriately fire stopped by fire doors or fire dampers, and voids around pipes, ducts, conduits, etc. are sealed with fireproof materials.
   b. The use of ink marking pens on surfaces of any kind of materials receiving paint or other finish in exposed location.
3. Materials Related Items
   a. Asbestos or asbestos containing materials.
   b. Barbed wire in construction fencing.
   c. Water soluble treatment of insulation jackets or facings, to impede or retard smoke or flames.
4. Earthwork Related Items
   a. Use of explosives is prohibited.
   b. Grits as backfill material.
5. Masonry Related Items
   a. Chicken wire type masonry reinforcing.
   b. Cinder block.
   c. Muriatic acid.
6. Door Related Items
   a. Knock-down (KD) door frames.
   b. Thresholds raised more than 1/2" at doors indicated as wheelchair accessible.

7. Roofing Related Items
   a. Dead level roofs. All roofs must slope to drain.
   b. Pitch pans or pitch pockets.

PART 3 EXECUTION

Not Applicable

END OF SECTION

SECTION 01 64 00

OWNER-FURNISHED PRODUCTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Owner and Contractor responsibilities for items furnished by the Owner.

1.02 OWNER'S RESPONSIBILITIES

A. Where applicable, provide the following:

1. Arrange for delivery of shop drawings, product data, samples, manufacturer's instructions, and certificates to Contractor.
2. Deliver supplier's bill of materials to Contractor.

B. Arrange and pay for delivery to site in accordance with Contractor's progress schedule.

C. Inspect deliveries jointly with Contractor.

D. Submit claims for transportation damage.

E. Arrange for replacement of damaged, defective, or missing items.

F. Arrange for manufacturer's field services; arrange for and deliver manufacturer's warranties and bonds to Contractor.

1.03 CONTRACTOR'S RESPONSIBILITIES

A. Designate submittal and delivery dates for each product in a schedule of Owner furnished items. Submit this schedule concurrently with the first submission of the progress schedule.

B. Where applicable, review shop drawings, product data, samples, and other submittals.

C. Inspect deliveries jointly with Construction Manager, record shortages, and damaged or defective items.

D. Handle products at site, including uncrating and storage.

E. Protect products from damage, and from exposure to element.

F. Assemble, install, connect and adjust products.

G. Arrange for installation inspections required by public authorities.

H. Repair or replace items damaged or lost.

END OF SECTION

SECTION 01 71 23

FIELD ENGINEERING

PART 1 GENERAL

1.01 SUMMARY

A. This section specifies administrative and procedural requirements for field engineering services, including, but not necessarily limited to, the following:

1. Establishing and maintaining lines and levels;
2. Structural design of shores, forms and similar items provided by the subcontractor as part of their means and methods of construction.

1.02 SUBMITTALS

A. Project Record Documents: Where applicable, each contractor shall submit a record of work performed as required under the provisions of Section 01 78 39, Record Documents.

1.03 QUALITY ASSURANCE

A. Use adequate number of skilled workmen who are thoroughly trained and experienced in the necessary craft and who are completely familiar with the specified requirements and the methods needed for proper performance of the work.

PART 2 PRODUCTS

Nor Applicable

PART 3 EXECUTION

3.01 GENERAL

A. Each trade contractor is responsible for any and all layout required to complete their scope of work.

B. Verify layout information shown on the drawings, in relation to the property survey and existing benchmarks before proceeding to the layout work. Locate and protect existing benchmarks and control points. Preserve permanent reference points during construction.

C. Do not change or relocate benchmarks or control points without prior written approval. Promptly report lost or destroyed reference points, or requirements to relocate reference points, or requirements to relocate reference points because of

necessary changes in grades or locations.

D. Promptly replace lost or destroyed project control points. Base replacements on the original survey control points.

E. Existing Utilities and Equipment: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning site work, investigate and verify the existence and location of underground utilities and other construction.

F. Prior to construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer and water service piping.

3.02 PERFORMANCE

A. Working from lines and levels established by the property survey, establish benchmarks and markers to set lines and levels at each story of construction and elsewhere as needed to properly locate each element of the Project. Calculate and measure required dimensions within indicated or recognized tolerances. Do not scale drawings to determine dimensions.

B. Advise entities engaged in construction activities of marked lines and levels provided for their use. Provide a minimum of two column lines as control in two directions which shall be used as reference points.

C. As construction proceeds, check every major element for line, level and plumb.

D. Surveyor's Log: Maintain a surveyor' log of control and other survey work. Make this log available for reference.

E. Record deviations from required lines and levels, and advise the Architect when deviations that exceed indicated or recognized tolerances are detected. On Project Record Drawings, record deviations that are accepted and not corrected.

F. Existing Utilities: Furnish information necessary to adjust, move or relocate existing structures, utility poles, lines, services or other appurtenances located in, or affected by construction. Coordinate with local authorities having jurisdiction.

END OF SECTION

SECTION 01 73 00

EXECUTION REQUIREMENTS

PART 1 GENERAL

1.01 SUMMARY

A. Requirements of this Section apply to the Work of all other Sections.

B. Section Includes:

1. Examination of Substrate.
2. Preparation.
3. Installation.
4. Workmanship.
5. Protection.
6. Overhead Attachments.
7. Prohibited Methods.

1.02 RELATED SECTIONS

A. Quality Control: Section 01 45 00.

B. Cutting and Patching: Section 01 73 29.

C. Shop Drawings, Product Data and Samples: Section 01 33 23.

D. Product Requirements: Section 01 60 00.

1.03 STANDARDS

A. Standards, codes and regulations published by Manufacturer's Associations, governmental agencies and other regulatory authorities form a part of these Specifications as minimum requirements. Such references include the latest issue and all amendments up to 30 days prior to the Bid Date.

B. "Governing Authority" means all federal, state and local laws and regulations.

C. Where differences occur between the Contract Documents and such standards, the most restrictive requirement shall apply.

D. Supply all materials and perform all work in accordance with the Manufacturer's Specifications and installation procedures, and in conformance with published trade and manufacturer's association standards, unless specifically noted otherwise herein.

1.05 NON-CONFORMING WORK

A. Faulty work or work not in conformance with the Contract Documents will not be permitted by the Architect.

1. It is the responsibility of the Contractor to propose a remedy by means of detailed drawings and written documentation and submit such documentation to the Architect for comments.
2. All costs for the removal and reconstruction of such work, as well as additional services of the Architect, shall be paid for by the Contractor.

PART 2 PRODUCTS - NOT APPLICABLE

PART 3 EXECUTION

3.01 EXAMINATION OF SUBSTRATE

A. Examine the substrates or structure to which a product is to be applied or installed. Do not proceed until unsatisfactory conditions have been corrected. Starting the work indicates acceptance of conditions and the installer assumes full responsibility for results.

B. Check the substrate or structure for proper tolerances and clearances. Tolerances are listed under individual specification Sections.

3.02 PREPARATION

A. Substrate: Where the products are applied to a substrate, prepare the substrate as recommended by the product manufacturer. That generally includes the following:

1. Bringing substrate to a uniform surface by smoothing uneven surfaces and filling holes, cracks and depressions with recommended filler or compatible type material.
2. Depressed Slabs: Bring to required elevation to receive finished materials where finished materials cannot completely fill depression. Use approved cementitious filler or compatible type material. Coordinate depressed slab locations with finish material locations.
3. Remove substances such as dust, oils and other foreign matter, not compatible with the product.
4. Surfaces shall be dry, unless moisture content or wetting requirement is specified or recommended.

B. Concrete Slabs: Provide steel shot abrasive cleaning of concrete slabs receiving designated finish flooring materials.

1. Designated Finish Flooring Materials
   a. Cementitious or cementitious set materials.

b. Sheet flooring materials.
c. Waterproofing materials.
d. Paint materials.
e. Polymer or epoxy type seamless flooring.

2. Equipment: Electric powered portable unit with self-contained dust collection system. Size(s) of unit(s) and shot media suitable for conditions and proposed finish materials. WHEELABRATOR CORP. "Blastrac" or similar type system by SASE COMPANY INC., BW MANUFACTURING or INNOVATECH.
3. Cleaning: Remove concrete surfaces to sufficient depth to remove bond breakers and contaminants such as curing compounds, oils, and other foreign matter which may be detrimental to the completed flooring installation.
   a. Work smoothly and evenly over entire surface; avoid creating dips, ridges, or other imperfections which would show or telegraph in the completed installation.
   b. Small transitions for different flooring materials may be obtained by multiple passes if carefully executed to create smooth even slope of not more than 1/8" in 2 feet.
4. Clean floor as near as possible to flooring installation to avoid contamination from work of other trades. Protect clean floor from soiling with suitable sheet materials. Reclean soiled areas.

C. Inserts and Anchorages

1. Anchorages where not detailed are the responsibility of the installer to design a suitable connection, structurally sound, and aesthetically acceptable to the Architect. Furnish calculations, drawings and product data when requested by the Architect. Such information may or may not be returned as indicated in Section 01 33 23.
2. It is the responsibility of the installer to furnish built-in fastening devices for his/her product to the proper trade for installation as the work proceeds.
3. In the event such devices are not furnished in time to be built-in, it is the installer's responsibility to provide other methods for attaching their product. Submit drawings and other required data to the Architect.

D. Templates: Provide templates, diagrams and other coordinating documents to the proper Contractor, manufacturer or supplier of related items affecting the Work.

E. Dimensions

1. If the exact location of an item is not indicated by dimension on the Drawings or noted in the Specifications, the Architect reserves the right to determine such location in the field prior to roughing-in.
2. If the exact dimensions of a product are not indicated, the Architect reserves the right to determine dimensions prior to the ordering or fabrication of a product.
3. Such dimensional changes shall not be a basis for changes in the Contract Sum.

4. Where miscellaneous devices, such as thermostats, switches, controls, grilles, pipes, or outlets of any nature are not specifically located by the Contract Documents, request such location or obtain approval of the location prior to installation. If approval has not been obtained, the Architect may direct the relocation of such devices at the expense of the installer.

3.03 INSTALLATION

A. General: Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.

1. Make vertical work plumb and make horizontal work level.
2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
3. Conceal pipes, ducts, and wiring in finished areas, unless otherwise indicated.
    a. Where pipes occur in partitions, furred-out spaces and chases, determine exact location and size and fit entirely concealed into allotted space. Report conflicts to Architect prior to installation.
    b. Where two or more pipes are to installed in parallel, or parallel to the piping of other trades, the piping shall be installed with sufficient space between the pipes to allow for the proper application of pipe covering, painting, and servicing.
    c. Furnish advance information on locations and sizes of frames, boxes, sleeves and openings needed for the Work to installers.
4. Install work to allow for installation of future work identified on drawings.
5. Maintain minimum headroom clearance of 8 feet in spaces without a suspended ceiling.

B. Install products in accordance with manufacturer's recommendations or the requirements of trade associations, listed standards, Shop Drawings and Contract Documents.

C. If a conflict exists between these references, the most strict requirements govern. If printed instructions are not available, consult with the manufacturer or the manufacturer's field representative, where applicable.

D. Provide hangers, auxiliary framing, and other means for installing ceiling suspension systems, lighting fixtures, diffusers, and other equipment in ceilings to avoid ductwork, piping, etc.

1. Suspend from structural members (i.e. joists, beams, etc.), and not from ductwork or piping.
2. Provide supplemental framing members (i.e. angles, tubes, light gage steel framing, etc.) to span between structural members where required to support items of this paragraph C.

E. Install work that will not interfere with the proper installation of the Work of other

trades.

F. Install work in a manner to facilitate operating, servicing and repairing.

G. Install each component during weather conditions and Project status that will ensure the best possible results. Isolate each part of the completed construction from incompatible material as necessary to prevent deterioration.

H. Mounting Heights: Where mounting heights are not indicated, install individual components at standard mounting heights recognized within the industry for the particular application indicated. Refer questionable mounting height decisions to the Architect for final decision.

3.04 SPACE PREFERENCE

A. Carefully check and coordinate the location and level of all Work to avoid conflicts between all contractors. Where conflicts occur, the following preferences shall generally govern:

1. Recessed electrical light fixtures
2. High and medium pressure ductwork
3. Low pressure ductwork
4. Soil, waste, vent and storm piping
5. Sprinkler piping
6. Liquid heat transfer and refrigerant piping
7. Domestic water piping
8. Electrical conduits from branch circuits

B. However, no ductwork or liquid heat transfer main shall have preference over plumbing piping below plumbing fixtures, nor over electrical conduits above or below electrical switchgear and panels. No piping conveying liquids shall be installed directly over electrical or elevator equipment. No piping shall be installed in electrical or elevator equipment rooms.

C. Where headroom or space conditions resulting from application of these preferences appear inadequate, notify the Architect prior to installing the Work.

D. Coordinate the mounting heights of busways, electrical equipment and raceways to clear the opening heights of doors, the height of vehicles and the heights of equipment which needs to be routinely removed, and out of paths required for maintenance.

3.05 WORKMANSHIP

A. Install products straight, plumb, level and in line. Securely attach items to the substrate, using recommended adhesives, mechanical fasteners or other devices. Where holes are provided for attachment, do not field drill or cut new holes without the approval of the Architect.

B. Where applicable, match finished work to the approved samples or mock-ups.

C. Conceal fasteners wherever possible, unless exposed fasteners are permitted or specified.

D. Weld in accordance with AWS standards; comply with AWS for qualifications of operators and for workmanship.

E. Visual Effects: Provide uniform joint widths in exposed work. Arrange joints in exposed work to obtain the best visual effect. Refer questionable choices to the Architect for final decision.

F. Recheck measurements and dimensions, before starting each installation.

3.06 PROTECTION

A. Protect finished surfaces of product being installed and surrounding products from damage during installation. Provide protective devices as required and as recommended by the manufacturer. Cover work subject to damage at the end of each day's work.

B. Coat concealed surfaces of metal products with a bituminous or other approved coating to prevent contact between dissimilar metals or other material which can cause deterioration.

C. Correct damage by repairing or replacing as directed by the Architect. Repairing will be permitted only where the repair is undetectable and does not cause structural damage or interfere with proper functioning of the part.

D. Protect finish of installed products until Substantial Completion of the Project by use of wrappings, covers or other approved protective devices. Remove such protection immediately prior to final cleaning.

E. Limiting Exposures: Coordinate and supervise construction activities 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. Maintain exposures within the manufacturers recommended limits. Where applicable, such exposures include, but are not limited to, the following:

1. Excessive static or dynamic loading
2. Excessive internal or external pressure
3. Excessive high or low temperatures
4. Thermal shock
5. Excessively high or low humidity
6. Air contamination or pollution
7. Water or ice
8. Solvents
9. Chemicals
10. Light

11. Radiation
12. Puncture
13. Abrasion
14. Heavy traffic
15. Soiling, staining and corrosion
16. Bacteria
17. Rodent and insect infestation
18. Combustion
19. Electrical current
20. High speed operation
21. Improper lubrication
22. Unusual wear or other misuse
23. Contact between incompatible materials
24. Destructive testing
25. Misalignment
26. Excessive weathering
27. Unprotected storage
28. Improper shipping
29. Theft
30. Vandalism

F. Take precautions to protect existing concrete and asphalt pavement from damage due to vehicle loads, parking, and storage.

1. Schedule loading to minimize pavement material consolidation during hot weather. Distribute wheel loads to the greatest extent possible.

3.07 OVERHEAD ATTACHMENTS

A. Where overhead hangers are required, and not indicated on the drawings, provide one or more of the following as required:

1. Concrete inserts prior to placement of concrete or drilled type inserts after concrete is placed.
2. Trapeze from adjacent structure with suitable steel framing.
3. Connections to Structure: Suitable anchorage devices with a minimum load carrying capacity of 250 pounds plus safety factor of 4:1 for the applied load.
   a. Concrete: Steel expansion anchors. See Prohibited Material and Methods specified in Section 01 60 00.
   b. Steel: Bolted or welded connections to steel structure.

B. Where metal deck is furnished with hanger tabs or similar devices, applied total load, including work of other trades, not to exceed 75 pounds for each device. Loads in excess of permitted limit to be supported by trapeze framing as specified above.

C. Verify support requirements of heavy or unusual loads not specifically shown on drawings with Architect.

3.08 OPERATION AND MAINTENANCE

A. Contractor shall maintain all systems and equipment operated during construction. The contractor responsible for the installation of the system shall operate and maintain it. Make all repairs and perform all maintenance to assure Work is turned-over to Owner in first class condition.

B. Maintenance work includes:

1. Lubrication
2. Adjustments
3. Filter replacements
4. Chemical treatment.

END OF SECTION

SECTION 01 73 29

CUTTING AND PATCHING

PART 1 GENERAL

1.01 DESCRIPTION

A. Execute cutting, fitting or patching of Work, required to:

1. Make several parts fit properly.
2. Uncover Work to provide for installation of ill-timed Work.
3. Remove and replace defective Work.
4. Remove and replace Work not conforming to requirements of Contract Documents.
5. Remove samples of installed Work as specified for testing.
6. Install specified Work in existing construction.

B. In addition to contract requirements, upon written instructions of Architect:

1. Uncover Work to provide for Architect's observation of covered Work.
2. Remove samples of installed materials for testing.
3. Remove Work to provide for alteration of existing Work.

C. Do not endanger any Work by cutting or altering Work or any part of it.

1.02 SUBMITTALS

A. Prior to cutting which affects structural safety of Project, submit written notice to Architect, requesting consent to proceed with cutting, including:

1. Identification of Project.
2. Description of Affected Work.
3. Necessity for cutting.
4. Affect on other Work, on structural integrity of Project.
5. Description of proposed Work. Designate:
    a. Scope of cutting and patching.
    b. Contractor and trades to execute work.
    c. Products proposed to be used.
    d. Extent of refinishing.
6. Alternative to cutting and patching.
7. Designation of party responsible for cost of cutting and patching.

B. Should conditions of Work, or schedule indicate change of materials or methods, submit written recommendation to Architect, including:

1. Conditions indicating change.

2. Recommendations for alternative materials or methods.
3. Submittals as required for Substitutions.

C. Submit written notice to Architect, designating time Work will be uncovered, to provide observation.

PART 2 PRODUCTS

2.01 MATERIALS

A. Patching of materials and surfaces shall be in accordance with the requirements of the Contract Documents. Where not otherwise defined, patching shall match adjacent surfaces and proper materials shall be provided accordingly.

PART 3 EXECUTION

3.01 INSPECTION

A. Inspect existing conditions of Work, including elements subject to movement or damage during cutting and patching.

B. After uncovering Work, inspect conditions affecting installation of new products.

3.02 PREPARATION PRIOR TO CUTTING

A. Provide shoring, bracing and support as required to maintain structural integrity of Project.

B. Provide protection for other portions of the Project, including all Contractors' personnel.

3.03 PERFORMANCE

A. Execute fitting and adjustment of products to provide finished installation to comply with specified tolerances, finishes.

B. Execute cutting and demolition by method which will prevent damage to other Work, and will provide surface to receive installation of repairs and new Work.

1. No cutting shall be performed which will, in any way, reduce the structural strength of the building. Should such cutting be necessary, consult Architect and do not proceed with such operation unless written approval is given.
2. Finished Surfaces: Cur 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.

C. Restore Work which has been cut or removed; install new products to provide completed Work in accord with requirements of Contract Documents.

D. Patching of materials and surfaces shall be in accordance with the requirements of the Contract Documents. Where not otherwise defined, patching shall match existing or adjacent surfaces and proper materials shall be provided accordingly.

1. Wherever existing walls, floors, ceilings, etc., are cut, the exposed surfaces must be neatly finished by patching, painting, wall covering, etc., as required to blend patched areas into adjacent existing surfaces. Patched areas shall not be visible when viewing entire wall surface.
   a. 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.
2. Where painting or finishing of patched surfaces or application of wall or floor covering is required, finish the entire plane of surface in which patched area occurs.
3. Ceilings: Patch, repair, or rehang in-place ceilings as necessary to provide an even-plane surface of uniform appearance.
4. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition.

3.04 SLEEVES AND OPENINGS

A. Where pipes, conduits, ductwork or other materials pass through new walls, partitions, floors, roof or ceilings, provide suitable sleeves in these elements or provide openings where sleeves are not practical.

B. Close sleeves and openings to prevent passage of smoke or fire using approved methods and materials to maintain the fire rating of the construction being penetrated. See Section 07 84 00.

1. Unless otherwise indicated, extend floor sleeves 2" above finished floor.

C. Where pipes, conduit, ductwork etc., pass through, behind, or above existing construction, provide all cutting, patching, and refinishing for doing this work as specified herein.

D. Lintels: Provide steel or precast concrete lintels to span openings in masonry walls sized in accordance with schedule shown or as detailed on structural drawings. In general, lintels are not required for openings less than the width of masonry unit in which wall is being constructed. Penetrations under beams or other concentrated loads require approval of Architect.

3.05 CLEANING

A. Cleaning: Clean areas and spaces where cutting and patching are performed. Remove paint, mortar, oils, putty, and similar materials from adjacent finished surfaces.

END OF SECTION

SECTION 01 74 00

CLEANING

PART 1 GENERAL

1.01 GENERAL REQUIREMENTS

A. These requirements supplement paragraph 3.15, General Conditions. Refer to General Conditions for additional requirements.

B. Execute cleaning, during progress of the work and at completion of the work, as required by Contract Documents.

1.02 RELATED SECTIONS

A. Cutting and Patching: Section 01 73 29.

B. Cleaning for Specific Products or Work: Specification section for the work.

1.03 CLEANING AND DISPOSAL REQUIREMENTS

A. Standards: Maintain project in accord with the following safety and insurance standards:

1. Applicable Federal and State Requirements.
2. National Fire Protection Association.

B. Hazards Control: Contractor shall comply with the following requirements:

1. Store volatile wastes in covered metal containers, and remove from premises daily.
2. Prevent accumulation of wastes which create hazardous conditions.
3. Provide adequate ventilation during use of volatile or noxious substances.

C. Conduct cleaning and disposal operations to comply with local ordinances and anti-pollution laws.

1. Do not burn or bury rubbish and waste materials on project site.
2. Do not dispose of volatile wastes such as mineral spirits, oil or paint thinner in storm or sanitary sewers.
3. Do not dispose of waste into streams or waterways.
4. Wet down dry materials and rubbish to prevent dust.

D. Clean streets, highways, and private properties of all mud, earth, rubbish, rocks, refuse or other debris of any kind resulting from such work or related transportation to and from the work site.

PART 2 PRODUCTS

2.01 MATERIALS

A. Select and use cleaning materials and equipment with care to avoid scratching, marring, defacing, staining or discoloring surfaces cleaned.

B. Use only cleaning materials recommended by manufacturer of surfaces to be cleaned.

1. Use cleaning products that meet Green Seal GS-37, or if GS-37 is not applicable, use products that comply with the California Code of Regulations maximum allowable VOC levels.

C. Use cleaning materials only on surfaces recommended by the cleaning material manufacturer.

PART 3 EXECUTION

3.01 PROGRESS CLEANING

A. General: Clean Project site and work areas daily, including common areas. Enforce requirements strictly. Dispose of materials lawfully.

B. Provide, maintain and empty 55 gallon metal and dumpster type containers for collection of waste materials, debris and rubbish. Locate containers as directed by Architect.

1. Provide containers with adequate capacity to accommodate anticipated needs. If containers do not have adequate capacity, increase intervals of waste removal or capacity of containers until adequate capacity is provided.

C. At reasonable intervals during progress of Work, but in no case less than once a week, dispose of waste materials, debris and rubbish.

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

E. 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.

F. 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.

G. Direct Special Attention To:

1. Provide non-staining layout lines and other markings on masonry and concrete. Use chalk lines wherever possible and remove when no longer needed.
2. Remove all stains from concrete surfaces, including floors.
3. Shop marks shall not appear on exposed surfaces of any item.
4. Remove concrete, mortar and paint spatters.
5. Clean both brick and concrete unit masonry.
6. Protect aluminum frames during construction and thoroughly clean upon completion of the installation.

H. Clean interior surfaces before start of finish painting and continue cleaning on an as-needed basis until painting is finished.

I. Schedule operations so that dust and other contaminants resulting from cleaning process will not fall on wet or newly-coated surfaces.

J. Handle materials in a controlled manner with as few handlings as possible; do not drop or throw materials from heights.

K. Vacuum interior building areas where work is performed prior to painting and other finish work. Continue vacuum cleaning on an as needed basis until building is ready for occupancy.

L. Protect interior of ductwork during construction from accumulation of dirt, dust or debris.

M. Clean trash from all chases and concealed spaces before final enclosure.

3.02 FINAL CLEANING

A. General: Provide final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.

1. Leave Project clean and ready for occupancy.

B. Employ experienced workmen, or professional cleaners for final cleaning.

C. At the completion of the work, remove all surplus material, false work, temporary structures, including foundations thereof, plants of any description and debris of every nature resulting from their operations and put the site in a neat and orderly condition.

D. Clean exposed interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Restore reflective surfaces to their original condition.

E. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision obscuring materials. Replace chipped or broken glass and other damaged transparent materials. Polish mirrors and glass, taking care not to scratch surfaces.

F. Sweep concrete floors broom clean in unoccupied spaces.

G. Vacuum carpet and similar soft surfaces, removing debris and excess nap; shampoo if visible soil or stains remain.

H. Remove grease, dust, dirt, stains, labels, fingerprints and other foreign materials from sight-exposed interior and exterior surfaces, including light fixtures and lenses; polish surfaces so designated to a shine finish.

1. Clean finishes free of dust, stains, films and other foreign substances.
2. Clean transparent and glossy materials to a polished condition; remove foreign substances. Polish reflective surfaces to a clear shine.

I. Remove temporary protection and labels not required to remain

J. Clean surfaces of equipment; remove excess lubrication.

K. Remove debris, rubbish, dirt, etc. from open concealed spaces, chases and above ceilings.

L. Repair, patch and touch-up marred surfaces to specified finish, to match adjacent surfaces.

M. In preparation for substantial completion or occupancy, conduct final inspection of sight-exposed interior and exterior surfaces, and of concealed spaces.

N. Remove waste, foreign matter, and debris from roofs, gutters, areaways, and drainage systems.

O. Clean plumbing fixtures to a sanitary condition.

P. Clean permanent filters of ventilating equipment and replace disposable filters when units have been operated during construction; in addition, clean ducts, blowers, and coils when units have been operated without filters during construction.

Q. Clean light fixtures and lamps; polish lenses.

R. Clean dirt and debris from interior of all electrical panels and user accessible electrical enclosure boxes prior to installation of covers or in the case of hinged

access doors, before final cleaning of adjacent space. Clean the exterior surfaces of all switchgear located in Mechanical and Electrical Rooms and spaces.

S. 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.

T. Clean dirt and dust from interior of air handling units before installing final filters. Wipe down the exterior surfaces of all HVAC equipment located in Mechanical Rooms and spaces.

1. Exposed painted ductwork to be brushed clean of dust.

U. Site/Exterior Items: Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.

1. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
2. Rake grounds that are neither planted nor paved to a smooth, even textured surface.
3. Remove tools, construction equipment, machinery, and surplus material from Project site.
4. Clean exposed hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces.

V. Maintain cleaning until Final Completion.

W. Prior to Final Completion, or Owner occupancy, Contractor shall conduct an inspection of sight exposed interior and exterior surfaces, and all work areas, to verify that the entire work is clean.

END OF SECTION

SECTION 01 74 19

CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

PART 1 GENERAL

1.01 SUMMARY

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

1. Salvaging nonhazardous demolition and construction waste.
2. Recycling nonhazardous demolition and construction waste.
3. Disposing of nonhazardous demolition and construction waste.

1.02 RELATED SECTIONS

A. Selective Demolition - for disposition of waste resulting from partial demolition of buildings, structures, and site improvements: Section 02 41 19.

B. Structure Demolition - for disposition of waste resulting from demolition of buildings, structures, and site improvements: Section 02 41 16.

C. Masonry – for disposal requirements for masonry waste: Section 04 00 00.

1.03 DEFINITIONS

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

B. Demolition Waste: Building and site improvement materials resulting from demolition or selective demolition operations.

C. Disposal: Removal off-site of demolition and construction waste and subsequent sale, recycling, reuse, or deposit in landfill or incinerator acceptable to authorities having jurisdiction.

D. Recycle: Recovery of demolition or construction waste for subsequent processing in preparation for reuse.

E. Salvage: Recovery of demolition or construction waste and subsequent sale or reuse in another facility.

F. Salvage and Reuse: Recovery of demolition or construction waste and subsequent incorporation into the Work.

1.04 PERFORMANCE GOALS

A. General: Achieve end-of-Project rates for salvage/recycling of 75 percent by weight of total nonhazardous solid waste generated by the Work. Practice efficient waste management in the use of materials in the course of the Work. Use all reasonable means to divert construction and demolition waste from landfills and incinerators. Facilitate recycling and salvage of materials.

1.05 QUALITY ASSURANCE

A. Refrigerant Recovery Technician Qualifications: Certified by EPA-approved certification program.

B. Regulatory Requirements: Comply with hauling and disposal regulations of authorities having jurisdiction.

C. Waste Management Conference: Conduct conference at Project site to comply with requirements in Section 01 31 00, "Project Management and Coordination." Review methods and procedures related to waste management including, but not limited to, the following:

1. Review and discuss waste management plan including responsibilities of waste management coordinator.
2. Review requirements for documenting quantities of each type of waste and its disposition.
3. Review and finalize procedures for materials separation and verify availability of containers and bins needed to avoid delays.
4. Review procedures for periodic waste collection and transportation to recycling and disposal facilities.
5. Review waste management requirements for each trade.

1.06 SUBMITTALS

A. Waste Management Plan: Submit 2 copies of plan within 14 days after the Notice to Proceed.

B. Waste Reduction Progress Reports: Concurrent with each Application for Payment, submit report. Include separate reports for demolition and construction waste. Include the following information:

1. Material category.
2. Generation point of waste.
3. Total quantity of waste in tons.
4. Quantity of waste salvaged, both estimated and actual in tons.
5. Quantity of waste recycled, both estimated and actual in tons.
6. Total quantity of waste recovered (salvaged plus recycled) in tons.
7. Total quantity of waste recovered (salvaged plus recycled) as a percentage of total waste.

C. Waste Reduction Calculations: Before request for Substantial Completion, submit three (3) copies of calculated end-of-Project rates for salvage, recycling, and disposal as a percentage of total waste generated by the Work.

D. Records of Donations: Indicate receipt and acceptance of salvageable waste donated to individuals and organizations. Indicate whether organization is tax exempt.

E. Records of Sales: Indicate receipt and acceptance of salvageable waste sold to individuals and organizations. Indicate whether organization is tax exempt.

F. Recycling and Processing Facility Records: Indicate receipt and acceptance of recyclable waste by recycling and processing facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.

G. Landfill and Incinerator Disposal Records: Indicate receipt and acceptance of waste by landfills and incinerator facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.

H. LEED Submittal: LEED letter template for Credit MR 2, signed by Contractor, tabulating total waste material, quantities diverted and means by which it is diverted, and statement that requirements for the credit have been met.

I. Qualification Data: For waste management coordinator and refrigerant recovery technician.

J. Statement of Refrigerant Recovery: Signed by refrigerant recovery technician responsible for recovering refrigerant, stating that all refrigerant that was present was recovered and that recovery was performed according to EPA regulations. Include name and address of technician and date refrigerant was recovered.

1.07 QUALITY ASSURANCE

A. Waste Management Coordinator Qualifications: LEED Accredited Professional by U.S. Green Building Council.

B. Regulatory Requirements: Comply with hauling and disposal regulations of authorities having jurisdiction.

C. Waste Management Conference: Conduct conference at Project site to comply with requirements in Section 01 31 19 "Project Meetings." Review methods and procedures related to waste management including, but not limited to, the following:

1. Review and discuss waste management plan including responsibilities of Waste Management Coordinator.
2. Review requirements for documenting quantities of each type of waste and its disposition.
3. Review and finalize procedures for materials separation and verify availability of containers and bins needed to avoid delays.
4. Review procedures for periodic waste collection and transportation to recycling and disposal facilities.
5. Review waste management requirements for each trade.

1.08 WASTE MANAGEMENT PLAN

A. General: Develop a waste management plan according to ASTM E1609 and requirements of this Section. Plan shall consist of waste identification, waste reduction work plan, and cost/revenue analysis. Indicate quantities by weight or volume, but use same units of measure throughout waste management plan.

B. Waste Identification: Indicate anticipated types and quantities of site-clearing and construction waste generated by the Work. Use Form CWM-1 for construction waste. Include estimated quantities and assumptions for estimates.

C. Waste Reduction Work Plan: List each type of waste and whether it will be salvaged, recycled, or disposed of in landfill or incinerator. Include points of waste generation, total quantity of each type of waste, quantity for each means of recovery, and handling and transportation procedures.

1. Salvaged Materials for Reuse: For materials that will be salvaged and reused in this Project, describe methods for preparing salvaged materials before incorporation into the Work.
2. Salvaged Materials for Sale: For materials that will be sold to individuals and organizations, include list of their names, addresses, and telephone numbers.
3. Salvaged Materials for Donation: For materials that will be donated to individuals and organizations, include list of their names, addresses, and telephone numbers.
4. Recycled Materials: Include list of local receivers and processors and type of recycled materials each will accept. Include names, addresses, and telephone numbers.
5. Disposed Materials: Indicate how and where materials will be disposed of. Include name, address, and telephone number of each landfill and incinerator facility.
6. Handling and Transportation Procedures: Include method that will be used for separating recyclable waste including sizes of containers, container labeling, and designated location on Project site where materials separation will be located.

PART 2 PRODUCTS **(Not Used)**

PART 3 EXECUTION

3.01 PLAN IMPLEMENTATION

A. General: Implement approved waste management plan. Provide handling, containers, storage, signage, transportation, and other items as required to implement waste management plan during the entire duration of the Contract.

1. Comply with Division 01 Section "Temporary Facilities and Controls" for operation, termination, and removal requirements.

B. Training: Train workers, subcontractors, and suppliers on proper waste management procedures, as appropriate for the Work occurring at Project site.

1. Distribute waste management plan to entities when they first begin work on-site. Review plan procedures and locations established for salvage, recycling, and disposal.

C. Site Access and Temporary Controls: Conduct waste management operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.

1. Designate and label specific areas on Project site necessary for separating materials that are to be salvaged, recycled, reused, donated, and sold.
2. Comply with Section 01 50 00 "Temporary Facilities and Controls" for controlling dust and dirt, environmental protection, and noise control.

3.02 SALVAGING DEMOLITION WASTE

A. Salvaged Items for Reuse in the Work: Salvage items for reuse and handle as follows:
1. Clean salvaged items.
2. Pack or crate items after cleaning. Identify contents of containers with label indicating elements, date of removal, quantity, and location where removed.
3. Store items in a secure area until installation.
4. Protect items from damage during transport and storage.
5. Install salvaged items to comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make items functional for use indicated.

B. Salvaged Items for Sale and Donation: Not permitted on Project site.

C. Salvaged Items for Owner's Use: Salvage items for Owner's use and handle as follows:
1. Clean salvaged items.
2. Pack or crate items after cleaning. Identify contents of containers with label indicating elements, date of removal, quantity, and location where removed.
3. Store items in a secure area until delivery to Owner.
4. Transport items to Owner's storage area designated by Owner.
5. Protect items from damage during transport and storage.

D. Doors and Hardware: Brace open end of door frames. Except for removing door closers, leave door hardware attached to doors.

E. Equipment: Drain tanks, piping, and fixtures. Seal openings with caps or plugs. Protect equipment from exposure to weather.

F. Plumbing Fixtures: Separate by type and size.

G. Lighting Fixtures: Separate lamps by type and protect from breakage.

H. Electrical Devices: Separate switches, receptacles, switchgear, transformers, meters, panelboards, circuit breakers, and other devices by type.

3.03 RECYCLING DEMOLITION AND CONSTRUCTION WASTE, GENERAL

A. General: Recycle paper and beverage containers used by on-site workers.

B. Recycling Incentives: Revenues, savings, rebates, tax credits, and other incentives received for recycling waste materials shall accrue to Contractor.

C. Preparation of Waste: Prepare and maintain recyclable waste materials according to recycling or reuse facility requirements. Maintain materials free of dirt, adhesives, solvents, petroleum contamination, and other substances deleterious to the recycling process.

D. Procedures: Separate recyclable waste from other waste materials, trash, and debris. Separate recyclable waste by type at Project site to the maximum extent practical according to approved construction waste management plan.

1. Provide appropriately marked containers or bins for controlling recyclable waste until they are removed from Project site. Include list of acceptable and unacceptable materials at each container and bin.
   a. Inspect containers and bins for contamination and remove contaminated materials if found.
2. Stockpile processed materials on-site without intermixing with other materials. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
3. Stockpile materials away from construction area. Do not store within drip line of remaining trees.
4. Store components off the ground and protect from the weather.
5. Remove recyclable waste off Owner's property and transport to recycling receiver or processor.

3.04 RECYCLING DEMOLITION WASTE

A. Asphaltic Concrete Paving: Break up and transport paving to asphalt-recycling facility.

B. Concrete: Remove reinforcement and other metals from concrete and sort with other metals.

1. Pulverize concrete to maximum 1-1/2-inch size.
2. Crush concrete and screen to comply with requirements in Division 31 Section "Earthwork" for use as satisfactory soil for fill or sub base.

C. Masonry: Remove metal reinforcement, anchors, and ties from masonry and sort with other metals.

1. Clean and stack undamaged, whole masonry units on wood pallets.

D. Wood Materials: Sort and stack members according to size, type, and length. Separate lumber, engineered wood products, panel products, and treated wood materials.

E. Metals: Separate metals by type.

1. Structural Steel: Stack members according to size, type of member, and length.
2. Remove and dispose of bolts, nuts, washers, and other rough hardware.

F. Asphalt Shingles: Separate organic and glass fiber asphalt shingles and felts. Remove and dispose of nails, staples and accessories.

G. Gypsum Board: Stack large clean pieces on wood pallets or in container and store in dry location. Remove edge trim and sort with other metals. Remove and dispose of fasteners.

H. Acoustical Ceiling Panels and Tile: Stack large clean pieces on wood pallets and store in dry location.

I. Metal Suspension System: Separate metal members, including trim and other metals, from acoustical panels and tile and sort with other metals.

J. Carpet and Pad: Roll large pieces tightly after removing debris, trash, adhesive, and tack strips.

K. Equipment: Drain tanks, piping, and fixtures. Seal openings with caps or plugs. Protect equipment from exposure to weather.

L. Plumbing Fixtures: Separate by type and size.

M. Piping: Reduce piping to straight lengths and store by type and size. Separate supports, hangers, valves, sprinklers, and other components by type and size.

N. Lighting Fixtures: Separate lamps by type and protect from breakage.

O. Electrical Devices: Separate switches, receptacles, switchgear, transformers, meters, panelboards, circuit breakers, and other devices by type.

P. Conduit: Reduce conduit to straight lengths and store by type and size.

3.05 RECYCLING CONSTRUCTION WASTE

A. Packaging

1. Cardboard and Boxes: Break down packaging into flat sheets. Bundle and store in a dry location.
2. Polystyrene Packaging: Separate and bag materials.

3. Pallets: As much as possible, require deliveries using pallets to remove pallets from Project site. For pallets that remain on-site, break down pallets into component wood pieces and comply with requirements for recycling wood.
4. Crates: Break down crates into component wood pieces and comply with requirements for recycling wood.

B. Site-Clearing Wastes: Chip brush, branches, and trees at landfill facility.

1. Comply with requirements in Division 32 Section "Plants" for use of chipped organic waste as organic mulch.

C. Wood Materials:

1. Clean Cut-Offs of Lumber: Grind or chip into small pieces.
2. Clean Sawdust: Bag sawdust that does not contain painted or treated wood.
   a. Comply with requirements in Division 32 Section "Plants." for use of clean sawdust as organic mulch.

D. Gypsum Board: Stack large clean pieces on wood pallets or in container and store in a dry location.

1. Clean Gypsum Board: Grind scraps of clean gypsum board using small mobile chipper or hammer mill. Screen out paper after grinding.

3.06 DISPOSAL OF WASTE

A. General: Except for items or materials to be salvaged, or otherwise reused, remove waste materials from Project site and legally dispose of them in a landfill or incinerator acceptable to authorities having jurisdiction.

1. Except as otherwise specified, do not allow waste materials that are to be disposed of accumulate on-site.
2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.

B. Burning: Do not burn waste materials.

C. Disposal: Remove waste materials from Owner's property and legally dispose of them.

END OF SECTION

SECTION 01 77 00

PROJECT CLOSEOUT

PART 1 GENERAL

1.01 GENERAL REQUIREMENTS

A. Comply with requirements stated in Conditions of the Contract and in Specifications for administrative procedures in closing out the work.

B. Related Requirements

1. Fiscal Provisions, Legal Submittals and Additional Administrative Requirements: Conditions of the Contract.
2. Operating and Maintenance Data: The respective specification sections.
3. Warranties and Bonds: The respective specification sections.
4. Close-out Submittals Required of Each Contractor: The respective specification sections.
5. Final property survey: Section 01 50 00.

1.02 SUBSTANTIAL COMPLETION

A. When Contractor considers the work to be substantially complete, he shall submit to the Architect:

1. A written notice that the work, or designated portion thereof, is substantially complete.
2. A list of items to be completed or corrected.

B. Within a reasonable time after receipt of such notice, the Architect will make an inspection to determine the status of completion.

C. Should the Architect determine that the work is not substantially complete:

1. Architect will promptly notify the Contractor in writing, giving the reasons therefore.
2. Contractor shall remedy the deficiencies in the work, and send a second written notice of substantial completion to the Architect.
3. Architect will re-inspect the work.

D. When the Architect concurs that the work is substantially complete, he will:

1. Prepare a Certificate of Substantial Completion on AIA Form G 704, accompanied by Contractor's list of items to be completed or corrected as verified and amended by the Architect.
2. Submit the Certificates to Owner and Contractor for their written

acceptance of the responsibilities assigned to them in the Certificate.

1.03 FINAL INSPECTION/COMPLETION

A. When a Contractor considers the work is complete, he shall submit written certification that:

1. Contract Documents have been reviewed.
2. Work has been inspected for compliance with Contract Documents.
3. Work has been completed in accordance with Contract Documents.
4. Equipment and systems have been tested in the presence of the Owner's representative and are operational.
5. Work is completed and ready for final inspection.

B. Submit certified copy of Owner and Architect's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Owner and Architect. The certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.

C. Architect will make an inspection to verify the status of completion with reasonable promptness after receipt of such certification.

D. Should Architect consider that the work is incomplete or defective:

1. Architect will promptly notify the Contractor, in writing, listing the incomplete or defective work.
2. Contractor shall take immediate steps to remedy the stated deficiencies, and send a second written certification to Architect that the work is complete.
3. Architect will reinspect the work.

E. When the Architect finds that the work is acceptable under the Contract Documents, he shall request the Contractor to make closeout submittals.

1.04 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

A. Preparation: Submit 2 copies of list. Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction.

1. Organize list of spaces in sequential order, starting with exterior areas first and proceeding from lowest floor to highest floor.
2. Organize items applying to each space by major element, including categories for ceiling, individual walls, floors, equipment, and building systems.
3. Include the following information at the top of each page:
   a. Project name.
   b. Date.

c. Name of Architect.
d. Name of Contractor.
e. Page number.

4. Submit list of incomplete items in the following format:
   a. PDF electronic file.

1.05 CLOSE-OUT SUBMITTALS

A. Evidence of compliance with requirements of governing authorities:

1. Certificate of Occupancy
2. Certificates of Inspection
   a. Plumbing
   b. Fire Protection
   c. HVAC
   d. Electrical
   e. Health Department

B. Project Record Documents: To requirements of Section 01 78 39.

C. Warranties and Bonds: To requirements of respective Specification Sections.

1. Submittal Time: Submit written warranties on request of Architect for designated portions of the Work where commencement of warranties other than date of **substantial completion** is indicated.
2. 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.
3. Organize warranty documents into an orderly sequence based on the table of contents of the Project Manual.
   a. Bind warranties and bonds in heavy-duty, 3-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch paper.
   b. Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product and the name, address, and telephone number of Installer.
   c. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project name, and name of Contractor.
4. Provide additional copies of each warranty to include in operation and maintenance manuals.

D. Evidence of Payment and Release of Liens: To requirements of General and Special Conditions.

E. Certificate of Insurance for Products and Completed Operations.

F. Unless a greater number of hard copies are indicated, provide two (2) copies and an electronic (pdf) file of all submittals.

G. Submit all Quality Assurance/Quality Control reports. See Section 01 40 00.

H. Submit copies of all RFIs, ASIs, addenda and bulletins. Include all attachments.

I. Maintenance Materials (Attic Stock): Submit a complete list of required maintenance materials.

J. Final Project Schedule: Indicate completion dates of all items.

1.05 FINAL ADJUSTMENT OF ACCOUNTS

A. Submit a final statement of accounting to Architect.

B. Statement shall reflect all adjustments to the Contract Sum:

1. The original Contract sum.
2. Additions and Deductions Resulting From:
    a. Previous Change Orders
    b. Allowances
    c. Unit Price
    d. Deductions for uncorrected work
    e. Other adjustments
3. Total Contract sum, as adjusted.
4. Previous payments
5. Sum remaining due

C. Architect will prepare a final Change Order reflecting approved adjustments to the Contract Sum which were not previously made by Change Orders.

1.06 FINAL APPLICATION FOR PAYMENT

A. Contractor shall submit the final Application for Payment in accordance with procedures and requirements stated in the Conditions of the Contract.

END OF SECTION

SECTION 01 78 23

OPERATION AND MAINTENANCE DATA

PART 1 GENERAL

1.01 GENERAL REQUIREMENTS

A. Compile product data and related information appropriate for Owner's maintenance and operation of products furnished under contract.

B. Instruct Owner's designated personnel in the maintenance of products and in the operation of equipment and systems.

C. Related Requirements

1. Each respective section of specifications listing operating and maintenance data requested for specific products.
2. Division 22: Additional Plumbing requirements.
3. Division 23: Additional HVAC requirements.
3. Division 26: Additional Electrical requirements.

1.02 QUALITY ASSURANCE

A. Preparation of data shall be performed by personnel:

1. Trained and experienced in maintenance and operation of described product.
2. Skilled to extent required to communicate essential written data and prepare required drawings.

1.03 FORM OF SUBMITTALS

A. Prepare data in the form of an instructional manual for use by Owner's personnel.

1. 2 hard copies
2. 1 electronic copy (USB device).

B. Format for Manuals

1. Size: 8-1/2 inch by 11 inch white paper for typed pages.
2. Text: Manufacturer's printed data or typewritten.
3. Drawings: Provide reinforced punched binder tab, bind in with text. Fold larger drawings to the size of the text pages.
4. Product Literature: Provide for each separate product or each piece of operating equipment. Include typed description of product and major component parts of equipment.

5. Cover: Identify each volume with type or printed title, "OPERATING AND MAINTENANCE INSTRUCTIONS", title of project, and general subject matter covered in the manual.

C. Binders: Commercial quality three-ring binders with durable plastic covers. When multiple binders are used, correlate data into consistent groupings.

1.04 CONTENT OF MANUAL

A. Title Page: Identify title of project, address, date of submittal, name, address and telephone number of Contractor and Architect.

B. Table of Contents: Typewritten list of each product or system required to be included.

C. Product Data

1. Include only those sheets which are pertinent to the specific product.
2 Annotate each sheet to:
   a. Clearly identify the specific product or part installed.
   b. Clearly identify the data applicable to the installation.
   c. Delete references to inapplicable information.

D. Drawings

1. Supplement product data with drawings as necessary to clearly illustrate:
   a. Relations of component parts of equipment and systems.
   b. Control and flow diagrams.
2. Coordinate drawings with information in Project Record Documents to assure correct illustration of completed installation.
3. Do not use Project Record Documents as maintenance drawings.

E. Written text, as required to supplement product data for the particular installation:

1. Organize in a consistent format under separate headings for different procedures.
2. Provide a logical sequence of instructions for each procedure.

F. Copy of each warranty, bond, and service contract issued.

G. Provide information sheet for Owner's personnel giving:

1. Proper procedures in the event of failure.
2. Instances which might affect the validity of warranties or bonds.

1.05 MANUAL FOR MATERIALS AND FINISHES

A. Submit two copies of complete manual in final form.

B. Content for architectural products, applied materials, and finishes:

1. Manufacturer's data, giving full information on products.
2. Catalog number, size, composition.
3. Color and texture designations.
4. Information required for reordering specially manufactured products.
5. Instructions for care and maintenance.
6. Manufacturer's recommendation for types of cleaning agents and methods.
7. Cautions against cleaning agents and methods which are detrimental to the product.
8. Recommended schedule for cleaning and maintenance.
9. Housekeeping Manuals containing manufacturer's recommended cleaning practices for vinyl wallcoverings, painted surfaces and all floor finishes.

C. Content for moisture protection and weather exposed products:

1. Manufacturer's data, giving full information on products.
2. Applicable standards.
3. Chemical composition.
4. Details of installation.

D. Instructions for inspection, maintenance and repair.

E. Additional requirements for maintenance data: The respective sections of Specifications.

F. Provide complete information for products of applicable sections of the Project Manual including, but not limited to, the following types of materials, as applicable:

1. Metal fabrications.
2. Waterproofing.
3. Roofing.
4. Flashing and sheet metal.
5. Roof accessories.
6. Joint sealants.
7. Doors and frames.
8. Windows.
9. Hardware.
10. Glazing.
11. All finish materials.
12. Toilet partitions.
13. Toilet accessories.

1.06 MANUAL FOR EQUIPMENT AND SYSTEMS

A. Submit two copies of complete manual in final form.

B. Content for each unit of equipment and system, as appropriate:

1. Description of unit and component parts.
2. Function, normal operating characteristics, and limiting conditions.
3. Performance curves, engineering data, and tests.
4. Complete nomenclature and commercial number of all replaceable parts.

C. Operating Procedures

1. Start-up, break-in, routine and normal operating instructions.
2. Regulation, control, stopping, shutdown, and emergency instructions.
3. Summer and winter operating instructions.
4. Special operating instructions.

D. Maintenance Procedures

1. Routine operations.
2. Guide to "troubleshooting."
3. Disassembly, repair, and reassembly.
4. Alignment, adjusting, and checking.

E. Servicing and lubrication schedule.

1. List of lubricants required.

F. Manufacturer's printed operating and maintenance instructions.

G. Description of sequence of operation by control manufacturer.

H. Original manufacturer's parts list, illustrations, assembly drawings, and diagrams, required for maintenance.

1. Predicted life of parts subject to wear.
2. Items recommended to be stocked as spare parts.

I. As-installed control diagrams by controls manufacturer.

J. Coordination drawings.

1. As-installed color coded piping diagrams.

K. List of original manufacturer's spare parts, manufacturer's current prices, and recommended quantities to be maintained in storage.

L. Other data as required under pertinent sections of Specifications.

M. Content for each electrical and electronic system, as appropriate:

1. Description of system and component parts.
2. Function, normal operating characteristics and limiting conditions.
3. Performance curves, engineering data, and tests.

4. Complete nomenclature and commercial number of replaceable parts.
5. Circuit directories of panelboards.
6. Electrical service.
7. Controls.
8. Communications.
9. As-installed color-coded wiring diagrams.
10. Operating schedules
    a. Routine and normal operating instructions
    b. Sequences required.
    c. Special operating instructions.
11. Maintenance procedures
    a. Routine operations.
    b. Guide to"troubleshooting."
    c. Disassembly, repair, and reassembly.
    d. Adjustment and checking.
12. Manufacturer's printed operating and maintenance instructions.
13. List of original manufacturer's spare parts, manufacturer's current prices, and recommended quantities to be maintained in storage.
14. Other data as required under pertinent sections of Specifications.

N. Prepare and include additional data when the need for such data becomes apparent during the instruction of Owner's personnel.

O. Additional requirements for operating and maintenance data: The respective sections of Specifications.

P. Provide complete information for products of applicable sections of the Project Manual including, but not limited to, the following types of materials:

1. Drainage systems.
2. Plumbing systems.
3. Domestic water conditioners.
4. Fire protection.
5. Power or heat generation.
6. Air distribution.
7. Controls and instrumentation.
8. Motors.
9. Power generation and transmission.
10. Service and distribution.
11. Lighting.
12. Special systems.
13. Communications.
14. Chemical Treatment.

1.07 SUBMITTAL SCHEDULE

A. Submit two copies of preliminary draft of proposed formats and outlines of contents 6 months before project completion.

B. Submit one copy of completed data in final form before final inspection and acceptance.

C. Submit specified number of copies of approved data in final form after final inspection and acceptance.

1.08 INSTRUCTION OF OWNER'S PERSONNEL

A. Before final inspection or acceptance, fully instruct Owner's designated operating and maintenance personnel in the operation, adjustment and maintenance of all products, equipment and systems.

B. Operating and maintenance manual shall constitute the basis of instruction.

C. Review contents of manual with personnel in full detail to explain all aspects of operation and maintenance.

END OF SECTION

SECTION 01 78 39

PROJECT RECORD DOCUMENTS

PART 1 GENERAL

1.01 GENERAL

A. Refer to General Conditions for additional requirements.

B. Each Prime Contractor: Maintain at the site one record copy of:

1. Drawings.
2. Specifications.
3. Addenda.
4. Change Order and other modifications to the Contract.
5. Architect's field orders or written instructions.
6. Approved shop drawings, product data and samples.
7. Field test records.
8. Approved permit sets.

C. Related Requirements

1. Conditions of the Contract.
2. Section 01 33 23: Shop Drawings, Product Data and Samples.
3. Operation and Maintenance Manuals: The respective specification sections.

1.02 MAINTENANCE OF DOCUMENTS AND SAMPLES

A. Store documents and samples in Contractor's field office apart from documents used for construction.

1. Provide files and racks for storage of documents.
2. Provide locked cabinet or secured storage space for storage of samples.

B. File documents and samples in accordance with the table of contents of the Project Manual.

C. Maintain documents in a clean, dry, legible condition and in good order. Do not use record documents for construction purposes.

D. Make documents and samples available at all times for inspection by the Architect.

1.03 MARKING DEVICES

A. Provide colored marking pens for recording information in the color code designated by Architect.

1.04 RECORDING

A. Label each document "PROJECT RECORD" in neat printed letters.

B. Record information concurrently with construction progress. Do not conceal any work until required information is recorded.

C. Drawings: Legibly mark to record actual construction.

1. Depths of various elements of foundation in relation to finish first floor datum.
2. Horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
3. Location of internal utilities and appurtenances concealed in the construction, referenced to visible and accessible features of the structure.
4. Field changes of dimension and detail.
5. Changes made by Field Order or by Change Order.
6. Details not on original contract drawings.

D. Specifications and Addenda: Legibly mark each Section to record:

1. Manufacturer, trade name, catalog number, and supplier of each product and item of equipment actually installed.
2. Changes made by Field Order or by Change Order.

1.05 SUBMITTAL

A. At Contract close-out, deliver Record Documents to Architect for submission to the Owner.

B. Accompany submittal with transmittal letter in duplicate, containing:

1. Date.
2. Project title and number.
3. Contractor's name and address.
4. Title and number of each Record Document.
5. Signature of Contractor or his authorized representative.

END OF SECTION

SECTION 01 79 00

DEMONSTRATION AND TRAINING

PART 1 GENERAL

1.01 SUMMARY

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

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

1.02 RELATED SECTIONS

A. Divisions 02 through 49 Sections for specific requirements for demonstration and training for products in those Sections.

1.03 SUBMITTALS

A. Instruction Program: Submit two copies of outline of instructional program for demonstration and training, including a schedule of proposed dates, times, length of instruction time, and instructors' names for each training module. Include learning objective and outline for each training module.

1. At completion of training, submit one complete training manual(s) for Owner's use.

1.04 QUALITY ASSURANCE

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

B. Instructor Qualifications: A factory-authorized service representative, complying with requirements in Division 01 Section "Quality Requirements," experienced in operation and maintenance procedures and training.

1.05 COORDINATION

A. Coordinate instruction schedule with Owner's operations. Adjust schedule as required to minimize disrupting Owner's operations.

B. Coordinate instructors, including providing notification of dates, times, length of instruction time, and course content.

C. Coordinate content of training modules with content of approved emergency, operation, and maintenance manuals. Do not submit instruction program until operation and maintenance data has been reviewed and approved by Architect.

PART 2 PRODUCTS

2.01 INSTRUCTION PROGRAM

A. Program Structure: Develop an instruction program that includes individual training modules for each system and equipment not part of a system, as required by individual Specification Sections, and as follows:

1. Motorized doors, including overhead coiling doors and automatic entrance doors.
2. Fire-protection systems, including fire alarm fire pumps and fire-extinguishing systems.
3. Medical equipment.
4. Laboratory equipment, including laboratory equipment and piping.
5. Heat generation, including boilers, feedwater equipment, pumps and water distribution piping.
6. Refrigeration systems, including chillers, condensers, pumps, and distribution piping.
7. HVAC systems, including air-handling equipment, air distribution systems and terminal equipment and devices
8. HVAC instrumentation and controls.
9. Electrical service and distribution, including transformers, switchboards, panelboards, and uninterruptible power supplies.
10. Packaged engine generators, including transfer switches.
11. Lighting equipment and controls.
12. Telecommunications Systems, including voice / data, wireless access points and cable television.
13. Audiovisual Systems, including Audiovisual System and Public Address equipment.
14. Security Systems, including Access Control System, Video Surveillance System, Intrusion Detection System, Wired Duress System, Wireless Duress System and Intercom equipment.

B. Training Modules: Develop a learning objective and teaching outline for each module. Include a description of specific skills and knowledge that participant is expected to master. For each module, include instruction for the following:

1. Basis of System Design, Operational Requirements, and Criteria: Include the following:
   a. System, subsystem, and equipment descriptions.
   b. Performance and design criteria if Contractor is delegated design responsibility.
   c. Operating standards.
   d. Regulatory requirements.
   e. Equipment function.
   f. Operating characteristics.

g. Limiting conditions.
h. Performance curves.

2. Documentation: Review the following items in detail:
   a. Emergency manuals.
   b. Operations manuals.
   c. Maintenance manuals.
   d. Project Record Documents.
   e. Identification systems.
   f. Warranties and bonds.
   g. Maintenance service agreements and similar continuing commitments.
3. Emergencies: Include the following, as applicable:
   a. Instructions on meaning of warnings, trouble indications, and error
   b. Instructions on stopping.
   c. Shutdown instructions for each type of emergency.
   d. Operating instructions for conditions outside normal operating Limits.
   e. Sequences for electric or electronic systems.
   f. Special operating instructions and procedures.
4. Operations: Include the following, as applicable:
   a. Startup procedures.
   b. Equipment or system break-in procedures.
   c. Routine and normal operating instructions.
   d. Regulation and control procedures.
   e. Control sequences.
   f. Safety procedures.
   g. Instructions on stopping.
   h. Normal shutdown instructions.
   i. Operating procedures for emergencies.
   j. Operating procedures for system, subsystem, or equipment failure.
   k. Seasonal and weekend operating instructions.
   l. Required sequences for electric or electronic systems.
   m. Special operating instructions and procedures.
5. Adjustments: Include the following:
   a. Alignments.
   b. Checking adjustments.
   c. Noise and vibration adjustments.
   d. Economy and efficiency adjustments.
6. Troubleshooting: Include the following:
   a. Diagnostic instructions.
   b. Test and inspection procedures.
7. Maintenance: Include the following:
   a. Inspection procedures.
   b. Types of cleaning agents to be used and methods of cleaning.
   c. List of cleaning agents and methods of cleaning detrimental to product.
   d. Procedures for routine cleaning
   e. Procedures for preventive maintenance.
   f. Procedures for routine maintenance.
   g. Instruction on use of special tools.

8. Repairs: Include the following:
   a. Diagnosis instructions.
   b. Repair instructions.
   c. Disassembly; component removal, repair, and replacement; and reassembly instructions.
   d. Instructions for identifying parts and components.
   e. Review of spare parts needed for operation and maintenance.

PART 3 EXECUTION

3.01 PREPARATION

A. Assemble educational materials necessary for instruction, including documentation and training module. Assemble training modules into a combined training manual.

B. Set up instructional equipment at instruction location.

3.02 INSTRUCTION

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

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

1. Owner will furnish Contractor with names and positions of participants.
2. Scheduling: Provide instruction at mutually agreed on times. For equipment that requires seasonal operation, provide similar instruction at start of each season.
   a. Schedule training with Owner with at least seven days' advance notice.
   b. Cleanup: Collect used and leftover educational materials and give to Owner. Remove instructional equipment. Restore systems and equipment to condition existing before initial training use.

3.03 DEMONSTRATION AND TRAINING VIDEOS

A. General: Engage a qualified commercial photographer to record demonstration and training videos. Record each training module separately. Include classroom instructions and demonstrations, board diagrams, and other visual aids, but not student practice.

1. At beginning of each training module, record each chart containing learning objective and lesson outline.

B. Video Recording Format: Provide high-quality color video recordings with menu navigation in format acceptable to Architect.

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

D. Narration: Describe scenes on videotape by audio narration by microphone while video is recorded. Include description of items being viewed. Describe vantage point, indicating location, direction (by compass point), and elevation or story of construction.

1. Assure narration is audible. Take care to assure mechanical equipment noise does not block out narration.

END OF SECTION

SECTION 018113
Scarborough Senior Housing
SUSTAINABLE DESIGN REQUIREMENTS

PART 1 - GENERAL

GENERAL CONDITIONS

A. The General Conditions, Modifications to General Conditions, Supplementary or Special Conditions and any Instructions to Bidders shall apply to all Divisions of work.

B. The requirements of State, Local or appropriate codes applicable to the work, whichever is the most stringent is a requirement of all Divisions of work.

WORK OF THIS SECTION

A. LEED Certification requirements

B. The intent of this project is to achieve a **Silver- level** LEED certification under the **LEED BD+C Homes and Multifamily Midrise** rating system.

C. Contractor shall coordinate work and requirements with Owner Contracted LEED Homes verification team comprising **LEED Provider and Green Rater**. Pertinent to LEED certifications the role of the verification team is to guide the construction team with certification process; review documentation, verify green requirements are met; and to perform third-party testing.

REFERENCES

A. American Society of Heating, Refrigerating and Air-Conditioning Engineers:
   1. ASHRAE 52.2 - Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size.
   2. ASHRAE 62 - Ventilation for Acceptable Indoor Air Quality.
   3. ASHRAE 90.1 - Energy Efficient Design of New Buildings except Low-Rise Residential Buildings.
   4. ASHRAE 129 - Measuring Air-Change Effectiveness.

B. ASTM International:
   1. ASTM E408 - Standard Test Methods for Total Normal Emittance of Surfaces Using Inspection-Meter Techniques.
   2. ASTM E903 - Standard Test Method for Solar Absorption, Reflectance, and Transmittance of Materials Using Integrating Spheres.

C. Bay Area Air Quality Management District: BAAQMD Regulation 8, Rule 51 –

D. Adhesive and Sealant Products. Carpet and Rug Institute: CRI Green Label Testing Program.

E. Forest Stewardship Council: FSC Guidelines- Forest Stewardship Council Guidelines.

F. Green Seal: GS-11 - Product Specific Environmental Requirements.

G. California Department of Public Health Standard Method V1.1–2010, using CA Section 01350, Appendix B.

H. Sheet Metal and Air Conditioning Contractors: SMACNA IAQ - IAQ Guidelines for Occupied Buildings under Construction.

I. South Coast Air Quality Management District: SCAQMD Rule 1168 - Adhesive and Sealant Applications.

J. U.S. Environmental Protection Agency:
   1. EPA 832-R-92-005 - Storm Water Management for Construction Activities: Developing Pollution Prevention Plans and Best Management Practices.
   2. EPA Baseline IAQ - Testing for Indoor Air Quality, Baseline IAQ, and Materials Section 01445
   3. EPA 402-K-01-002 – A Step-by-Step Guide on how to Build Radon-Resistant Homes

K. U.S. Green Building Council:
   1. LEED Version 4 - Reference Guide for Homes Design & Construction
   2. LEED v4 Multifamily Midrise Thermal Enclosure Checklist

L. ENERGY STAR Qualified Homes
   1. Energy Star Water Management System Builder Checklist

SUBMITTALS

A. The contractor shall submit the following items directly to the Green Rater.
   1. Attendee list of On-site LEED Trades Training meeting moderated by LEED Verification Team (LEED Green Rater and/or Provider-QAD)
   2. Energy Star Water Management System Builder Checklist signed and initialed by General Contractor.

B. If tropical wood is used – Provide invoices for FSC certified wood with Chain of Custody Certificate number.

C. Construction Waste Volume or Weight and Diversion Rate (Calculation and Waste Hauling Tickets)

D. If applicable, provide documentation of dates and times of preoccupancy flush schedule to Green Rater.

E. The contractor shall submit cut-sheets of products intended to comply with Environmentally Preferable Products (EEP). See LEED checklist for list of products intended to meet this requirement. EPP criteria are as follows:
   1. Recycled Content Requirement:
      a. Minimum 25% post-consumer or 50% post-industrial. OR
      b. The product contains at least 25% reclaimed material, including salvaged, refurbished, or reused materials.
      c. Bio-based materials. Bio-based products must meet the Sustainable Agriculture Network's Sustainable Agriculture Standard. Bio-based raw materials must be tested using ASTM Test Method D6866 and be legally harvested, as defined by the exporting and receiving country.
      d. Concrete that consists of at least 30% fly ash or slag used as a cement substitute and 50% recycled content or reclaimed aggregate OR 90% recycled content or reclaimed aggregate.
   2. Low Emissions Requirement– See specific requirements for Low-VOC paints, Adhesives and Sealants at end of this section.
   3. Local Production Requirement – Extracted, manufactured and fabricated (all processes) with in 100 mile crow-fly distance of site.

QUALITY ASSURANCE

1. Perform work in accordance with the **LEED Version 4 - Reference Guide for Homes Design & Construction** for prerequisites and credits pertinent to this project listed in LEED Checklist included at the end of this section.

A. Maintain one copy of LEED for Homes Rating System document on site. Download at

https://www.usgbc.org/resources/leed-v4-homes-and-multifamily-midrise-current-version

B. Perform inspections to assure conformance to Energy Star Checklists throughout construction of the project. A copy of all pertinent Energy Star Inspection Checklists is enclosed at end of this section.

C. Monitor closely any requests for substitution for products that are related to LEED prerequisites and credits. Unless reviewed thoroughly substitutions may jeopardize projects' ability to obtain certification.

D. Perform storm water management and erosion control Work in accordance with EPA Best Management Practices or local erosion and sedimentation control standards, whichever is more stringent.

E. Perform Work to meet or exceed minimum energy efficiency and performance in accordance with Energy Star requirements and local energy code, whichever is more stringent.

F. Perform Work without use of CFC based refrigerants in HVAC building systems.

G. Perform ventilation Work in accordance with ASHRAE 62.

H. Develop and implement construction indoor air quality management plan including the following:
   1. Comply with minimum requirements of SMACNA IAQ.
   2. Protect stored and installed absorptive materials from moisture damage.
      a. Store materials on elevated platforms under cover, and in dry location.
      b. When materials are not stored in enclosed location, cover tops and sides of material with secured waterproof sheeting.
   3. Protect HVAC equipment during construction.
      a. Shut down return side of HVAC system whenever possible during heavy construction or demolition.
      b. When HVAC system is operated during heavy construction, furnish disposable temporary filters.

PART 2 – PRODUCTS

PRODUCT SUBSTITUTION

A. Monitor closely any requests for substitution for products that are related to LEED prerequisites and credits. Unless reviewed thoroughly substitutions may jeopardize projects' ability to obtain certification.

PART 3 - EXECUTION

LEED PREREQUISITES AND CREDITS (See enclosed LEED Checklist for more information)

INTEGRATIVE PROCESS

A. IP Credit 1.3 (option 3) – Trades Training
   1. At the onset of construction organize a LEED trades training moderated by LEED Green Rater and/or Provider-QAD.
   2. Following trades to attend - GC Project Manager, GC Site Superintendent, Mechanical-Electrical-Plumbing, Insulation, Framing, Drywall, Air-Infiltration Package.
   3. Provide a minimum of 2-week notice to LEED Green Rater prior to training date.

SUSTAINABLE SITES

A. SS Prerequisite 1 - Construction Activity Pollution Prevention

1. Stockpile and protect disturbed topsoil from erosion (for reuse).
2. Control the path and velocity of runoff with silt fencing or comparable measures.
3. Protect on-site storm sewer inlets, streams, and lakes with straw bales, silt fencing, silt sacks, rock filters, or comparable measures.
4. Provide swales to divert surface water from hillsides.
5. Use tiers, erosion blankets, compost blankets, filter socks, berms, or comparable measures to stabilize soils in any area with a slope of 15% (6.6:1) or more that is disturbed during construction.
6. Prevent air pollution from dust and particulate matter.
7. Construction sites larger than 1 acre must conform to the erosion and sedimentation requirements of the 2012 U.S. Environmental Protection Agency Construction General Permit or local equivalent, whichever are more stringent.

B. SS Prerequisite 2 - No Invasive Plants

1. Coordinate with Landscape Contractor to ensure no invasive plant species are introduced into landscape.

C. SS Credit 3 – Non-toxic Pest Control

1. For below-grade walls, use solid concrete foundation walls, masonry walls with a course of solid block bond beam, or concrete-filled block.
2. Design a minimum 6-inch inspection space between the surface of the planned landscape grade and non-masonry siding.
3. Seal all external cracks, joints, penetrations, edges, and entry points with appropriate caulking. Install rodent and corrosion-proof screens (e.g., copper or stainless-steel mesh) on all openings greater than 1/4 inch, except where code prohibits their installation (e.g., dryer vents).
4. Design discharge points for rain gutters, air-conditioning condensation lines, steam vent lines, or any other moisture source such that discharge is at least 24 inches from the foundation.
5. Multifamily building projects **must** develop an integrated pest management policy that includes guidance for residents on pesticide use, housekeeping, and prompt reporting of pest problems; incorporate the policy in the Homeowner Education Manual.

WATER EFFICIENCY

A. WE Prerequisite 1 – Water Metering

1. Multifamily: Install a water meter for the entire building

B. WE Credit 2 – Indoor Water Use

Provide product date showing flow rates for following fixtures:

1. Average flow rate of lavatory faucets shall be 1.00 gallons per minute or less. Each lavatory faucet or faucet aerator must be WaterSense labeled.
2. Average flow rate of showers shall be 1.50 gallons per minute or less. Each showerhead fixture and fitting must be WaterSense labeled.

ENERGY & ATMOSPHERE

A. EA Prerequisite 1– Minimize Energy Performance (Multifamily Mid-rise)

1. Comply with Mandatory Provisions of ASHRAE 90.1, 2010.
2. Minimize envelope leakage
   The following areas of building envelope and demising walls shall be sealed, caulked, gasketed, or weather-stripped to minimize envelope leakage:
   a. Joints around windows and doors.
   b. Joints between walls and foundation; between conditioned spaces and attics, demising walls, crawl spaces or garage.
   c. Seal joints between sill plate and drywall.
   d. Seal joints between top plate and drywall.
   e. All mechanical, plumbing, and electrical penetrations in exterior and demising walls. Mechanical chase shall be sealed at crawl space ceiling.
   f. Exterior sheathing and house wrap.
   g. Minimize entry of air from outdoors, attic, garage, and crawl space into exterior wall and interior wall cavities to ensure passing of air infiltration test.
   h. Batt insulation shall be stapled to face of stud to ensure full contact of insulation with face of drywall. Cut insulation around all mechanical, plumbing, and electrical work.
3. Where applicable appliances must be ENERGY STAR qualified and installed in each dwelling unit: refrigerator; dishwasher; clothes washer.
4. All duct runs must be fully ducted (i.e., building cavities may not be used as ducts).
5. Reduced Heating and Cooling Distribution System Losses for In-unit HVAC. - The tested leakage-to-outside rate must be less than 4.0 cfm25 per 100 square feet of conditioned floor area for each installed system, verified by a qualified energy rater. For units smaller than 1200 square feet tested leakage must be less than 6.0 cfm25 per 100 square feet. Total duct leakage for in-unit systems must not exceed 8 cfm25 per 100 square feet of conditioned floor area. Testing is waived if the air-handler unit and all ductwork are visibly within the unit's envelope (i.e., no ducts are hidden in walls, chases, floors, or ceilings).
6. Thermal Bypass Inspection -
   The Green Rater will conduct a visual Thermal Bypass Inspection to inspect proper installation and continuity of thermal insulation and air-tightness of envelope. This inspection must take place after exterior envelope insulation has been installed, but prior to and installation of any drywall. One inspection per floor shall be conducted. If additional inspections are deemed necessary due construction sequencing, Contractor shall notify the Architect and Green Rater immediately. Contractor shall schedule the inspection with no less than two-week notice to the Green Rater. Contractor shall provide access to each unit and cooperate with conducting of the test. Additional inspections necessary due to incomplete work shall be back charged to the Contractor. A sample Thermal Bypass Inspection Checklist is enclosed in section 018113.
7. Final Inspections -
   Upon substantial completion and prior to occupancy, the Green Rater will conduct a visual Final Inspection to verify green requirements incorporated in the project. The contractor shall notify the Green Rater at least four (4) weeks prior to the anticipated date for such inspection. Contractor shall provide access to each unit and cooperate with conducting of the test. Additional inspections necessary due to incomplete work shall be back-charged to the Contractor.
8. Third-Party Testing -
   Third-party Testing is to be scheduled and conducted in conjunction with the final inspection. The contractor shall notify the Green Rater at least four (4) weeks prior to the anticipated date for such inspection. Contractor shall provide access to each unit and cooperate with conducting of the test. The following tests shall be conducted by Green Rater:

a. Air Infiltration Test (Blower door Test) – Mandatory – Measures air leakage through unit enclosure such as exterior walls, demising walls, ceilings, chases, etc.
b. Distribution Loss Test (Duct Blaster Test) – Mandatory – Measures leakage through the mechanical distribution system
c. Exhaust Test - Measures exhaust rate for bathroom fans and kitchen fans.
d. Flow Test and Balancing – Measure air flow at each supply register and pressure differential between rooms.

9. Testing & Balancing Common Areas central systems
   HVAC Contractor to hire a separate Testing and Balancing Agency to verify start-up and balance central commercial heating, cooling, water heating and ventilation systems. Submit Testing and Balancing report to Green Rater.
10. Fundamental Commissioning of Central HVAC Systems - HVAC Contractor to schedule walkthrough with Green Rater/Verifier to review start-up, operations, system verification for all central and common area HVAC systems.

B. EA Prerequisite 2 – Energy Metering

For Multifamily Buildings

1. Install an electricity meter or submeter for each residential unit and a gas meter for the entire building, or a gas meter or sub-meter for each unit. Single room–occupancy units, transitional and temporary housing, and designated supportive housing buildings do not need an energy meter in each unit but must have a whole-building energy meter.

C. EA Prerequisite 3 – Education of the Homeowner, Tenant, or Building Manager

1. General Contractor to provide to Owner or Owner's Building Management an operations and maintenance manual, binder, or CD that includes all the following items:
   a. the completed checklist of LEED-related features;
   b. a copy of each signed accountability form;
   c. copies of all ENERGY STAR for Home, version 3, checklists;
   d. product manufacturers' manuals for all installed equipment, fixtures, and appliances;
   e. general information on efficient use of energy, water, and natural resources;
   f. operations and maintenance guidance for any installed equipment, including space heating and cooling, mechanical ventilation, humidity control, radon protection, renewable energy, and irrigation, rainwater harvesting, or graywater systems (following 2009 EPA WaterSense Single-Family New Home Specifications, item 5.0, Homeowner Education);
2. LEED Green Rater to assist with following items for inclusion in manuals:
   a. guidance on occupants' activities and choices, including cleaning materials and methods, water-efficient landscaping, integrated pest management, effects of chemical fertilizers and pesticides, irrigation, lighting selection, and appliance selection;
   b. information on local green power options; and
   c. information on sharing utility data with USGBC via a USGBC-approved third party.
3. General Contractor to conduct a minimum one-hour walkthrough of the home with Owner and/or building manager. The walkthrough must feature the following:
   a. identification of all installed equipment;
   b. instruction in how to use and operate the equipment; and
   c. information on its maintenance.

MATERIALS & RESOURCES

A. MR Prerequisite 1 – Certified Tropical Wood

1. All wood in the building must be non-tropical, reused or reclaimed, or certified by the Forest Stewardship Council, or USGBC-approved equivalent.
2. If tropical wood is used it must be FSC Certified. Provide vendor's chain-of-custody certificate number must be shown on any invoice that includes FSC-certified products.

B. MR Prerequisite 2 – Durability Management

1. Meet the requirements of the ENERGY STAR for Homes, version 3, water management system builder checklist attached at end of this section.
2. Install all the applicable indoor moisture control measures:
   a. Area directly above bathtub, spa, or shower (extending to ceiling), exposed wall or area behind fiberglass enclosure if wallboard is installed - Use non-paper-faced backer board or paper-faced product or coating over wallboard that meets standard ASTM D 3273 standard
   b. Kitchen, bathroom, laundry room, spa area - Use water-resistant flooring; do not install carpet.
   c. Install water resistant flooring (not carpet) within 3 feet of exterior doors accessible from ground.
   d. Tank water heater in or over living space - Install drain and drain pan, drain pan and automatic water shut-off or flow restrictor, or floor drain with floor sloped to drain.
   e. Clothes washer (or condensing clothes dryer) in or over living space - Install drain and drain pan, drain pan and automatic water shut-off or flow restrictor, or floor drain with floor sloped to drain.
   f. Conventional clothes dryer - Exhaust directly to outdoors

C. MR Credit 1 – Durability Management Verification

1. LEED verification team (Green Rater) to inspect and verify each measure listed in the ENERGY STAR for Homes, version 3, water management system builder checklist.
2. Allow Green Rater access to the premise to inspect items in ENERGY STAR for Homes, version 3, water management system builder checklist.

D. MR Credit 2 – Environmentally Preferable Products

1. Option 1 - Local Production - Use products that were extracted, processed, and manufactured locally within 100 miles of site and for the following components (at least 50% of the component). Contractor to provide documentation proving compliance with Environmentally Preferable Product requirements for the following products:
   a. Aggregate for concrete and foundation
2. Option 2 – Environmentally Preferable Products –Use synthetic gypsum board products that contain at least 95% recycled content and non-synthetic gypsum board products that contain at least 10% post-consumer recycled content. Contractor to provide documentation proving compliance with Environmentally Preferable Product requirements for the following products:
   a. Drywall, Interior Finish

INDOOR ENVIRONMENTAL QUALITY

A. EQ Prerequisite 1 – Ventilation

Multifamily

1. Local Exhaust
   a. Design and install local exhaust systems in all bathrooms (including half-baths) and the kitchen to meet the requirements of ASHRAE Standard 62.2–2010, Sections 5 and 7 or local equivalent, whichever is more stringent. Provide minimum intermittent local exhaust flow rates of 100 cfm or 5ACH in kitchen, and 50 cfm in bathrooms.
   b. Exhaust air to the outdoors. Do not route exhaust ducts to terminate in attics or interstitial spaces. Just recirculating range hoods or recirculating over-the-range microwaves do not satisfy the kitchen exhaust requirements.
   c. Use ENERGY STAR–labeled bathroom exhaust fans in all bathrooms.
   d. For exhaust hood systems capable of exhausting in excess of 400 cubic feet per minute (188 liters per second), provide makeup air at a rate approximately equal to the exhaust air rate. Makeup air systems must have a means of closure and be automatically controlled to start and operate simultaneously with the exhaust system.

2. Ventilation
    a. Fresh air ventilation to dwelling units shall comply with ventilation requirements of ASHRAE 62.2–2010.
    b. Do not use systems that rely on transfer air from pressurized hallways or corridors, adjacent dwelling units, attics, etc.
    c. Project teams using exhaust-only ventilation systems must comply with flow rate required by ASHRAE 62.2–2010. If bathroom exhaust fan is used for exhaust-only fresh-air ventilation, then refer to HVAC drawings for exhaust fan run-time and controls. Coordinate continuous / intermittent fan run-time and controls with HVAC and Electrical contractor. Provide dual-speed bathroom exhaust fan with continuous speed set to 30 cfm in 1-Bedroom units, and 45 cfm in 2-Bedroom units.
    d. Continuous in-unit ventilation fans must be rated for sound at a maximum of 1.0 sone, per ASHRAE 62.2–2010, Section 7.2.1. Remote mounted fans need not meet these sound requirements.
    e. Locate air inlets that are part of the ventilation design at least 10 feet (3 meters) from known sources of contamination, such as a stack, vent, exhaust hood, or vehicle exhaust. Place the intake such that entering air is not obstructed by snow, plantings, or other material. Forced air inlets must be covered by screens to exclude rodents and insects (mesh not larger than 1/2 inch or 13 millimeters).
3. For all non-unit spaces, meet the minimum requirements of ASHRAE Standard 62.1–2010 or local equivalent, whichever is more stringent, Sections 4–7, Ventilation for Acceptable Indoor Air Quality (with errata). Mechanically ventilated spaces must be designed using the ventilation rate procedure or the applicable local code, whichever is more stringent. Ventilation fans that penetrate rated assemblies may require radiation and fire dampers to meet local building and fire codes.

B. EQ Prerequisite 2 – Combustion Venting

1. Do not install any unvented combustion appliances (ovens and ranges excluded).
2. Install a carbon monoxide (CO) monitor on each floor, hard-wired with a battery backup. In multifamily buildings, install a CO monitor on each floor of each unit.
3. For all fireplaces and woodstoves inside the building, provide doors that close or a solid glass enclosure. Interior fireplaces and woodstoves that are not closed-combustion or power-vented must pass BPI or RESNET combustion safety testing protocols to ensure that depressurization of the combustion appliance zone is less than 5 Pa.
4. Space- and water-heating equipment that involves combustion must meet one of the following:
    a. it must be designed and installed with closed combustion (i.e., sealed supply air and exhaust ducting);
    b. it must be designed and installed with power-vented exhaust; or
    c. it must be located in a detached utility building or open-air facility.

C. EQ Prerequisite 3 – Garage Pollutant Protection

1. Place all air-handling equipment and ductwork outside the fire-rated envelope of the garage.
2. Tightly seal shared surfaces between the garage and conditioned spaces, including all of the following:
    a. In conditioned spaces above the garage, seal all penetrations and all connecting floor and ceiling joist bays.
    b. In conditioned spaces next to the garage, weather-strip all doors, install carbon monoxide detectors in rooms that share a door with the garage, seal all penetrations, and seal all cracks at the base of the walls.

D. EQ Prerequisite 4 – Radon-Resistant Construction

New Construction

1. Provide a Passive or Active Radon Mitigation System per following requirements:

a. Install polyethylene sheeting or extruded polystyrene (XPS) insulation beneath concrete slabs, including basement floors. Ensure sheeting is in direct contact with the concrete slab above. Install a capillary break at all crawlspace floors using ≥ 6 mil polyethylene sheeting, lapped 6 to 12 in.
b. Under the polyethylene sheeting or extruded polystyrene (XPS) insulation installed to meet ENERGY STAR Water Management System Builder Checklist Item 1.3:
   i. Install a 4 in. layer of 1/2 in. diameter or greater clean aggregate; OR
   ii. Install a 4 in. uniform layer of sand, overlain with either a layer of geotextile drainage matting throughout or strips of geotextile drainage matting along the perimeter installed according to the manufacturer's instructions.
c. A 3 or 4 in. diameter gas-tight vertical vent pipe, clearly labeled to conform with the radon-resistant standard used, e.g., "Radon Reduction System" or "Radon Pipe" or "Radon System." The vent pipe shall be connected to an open T-fitting in the aggregate layer (or connected to geotextile drainage matting according to the manufacturer's instructions) beneath the polyethylene sheeting, extending up through the conditioned spaces and terminating a minimum of 12 in. above the roof opening. For crawlspaces, install at least 5 ft. of horizontal perforated drain tile on either side of the T-fitting, attached to the vertical radon vent pipe beneath the sheeting and running parallel to the long dimension of the house.
d. Radon fan installed in the attic (i.e., an active system) OR an electrical receptacle installed in an accessible attic location near the radon vent pipe (i.e., a passive system) to facilitate future fan installation if needed.

2. The requirements for radon protection are automatically satisfied if the building is elevated by at least 2 feet (600 millimeters), with open air space between the building and ground. An enclosed vented crawlspace does not qualify. A garage under a building is an acceptable alternative.
3. Foundation air sealing with polyurethane caulk or the equivalent at all slab openings, penetrations and control or expansion joints.

E. EQ Prerequisite 5 – Air Filtering

1. Install air filters with a minimum efficiency reporting value (MERV) of 8 or higher on all recirculating space conditioning systems, per ASHRAE 62.2–2010. Design ductwork and specify the central blower to account for the pressure drop across the filter. Air filter housings must be airtight to prevent bypass or leakage.
2. Non-ducted systems are exempt from the minimum MERV 8 requirements but must have an internal air filter in the air-handling unit.
3. Install air filters rated MERV 6 or higher for mechanically supplied outdoor air for systems with 10 feet (3 meters) of ductwork or more, per ASHRAE 62.2–2010, Section 6.7.

F. EQ Prerequisite 6 – Environmental Tobacco Smoke

1. Provide signage to:
   a. prohibit smoking in common areas,
   b. prohibit smoking within 25 feet of building entrances.
   c. or prohibit smoking on the entire property.

G. EQ Prerequisite 7 – Compartmentalization

1. Compartmentalize each residential unit to minimize leakage between units. Minimize uncontrolled pathways for environmental tobacco smoke and other indoor air pollutants between units by sealing penetrations in walls, ceilings, and floors and by sealing vertical chases (including utility chases, garbage chutes, mail drops, and elevator shafts) adjacent to the units.
2. Weather-strip all doors in the residential units leading to common hallways to minimize air leakage into the hallway. Weather-strip all exterior doors and operable windows to minimize leakage from outdoors.

3. Demonstrate acceptable sealing of residential units by a blower door test. Follow the procedure described by RESNET or the ENERGY STAR Multifamily High Rise Program Testing and Verification Protocols, Version 1.0, with an allowable maximum leakage of 0.30 cfm50 per square foot (0.07 cmm50 per square meter) of enclosure (i.e., all surfaces enclosing the apartment, including exterior and party walls, floors, and ceiling) for new construction buildings.
4. Third-party Testing is to be scheduled and conducted in conjunction with the final inspection. The contractor shall notify the Green Rater at least four (4) weeks prior to the anticipated date for such inspection. Contractor shall provide access to each unit and cooperate with conducting of the test. The following tests shall be conducted by Green Rater:
    a. Air Infiltration Test (Blower door Test) – Mandatory – Measures air leakage through unit enclosure.

H. EQ Credit 1.1 (option 1) – Enhanced Ventilation - Enhanced Local Exhaust

1. Use one of the following strategies in every bathroom with a shower, bathtub, or spa (i.e., half-baths are exempt) to control the use of the local exhaust fan:
    a. an occupancy sensor;
    b. an automatic humidistat controller;
    c. a continuously operating exhaust fan; or
    d. a delay timer that operates the fan for at least 20 minutes

I. EQ Credit 3.1 (option 1) – Balancing of H&C Distribution Systems - Multiple Zones

1. Single-family houses with less than 800 square feet (74 square meters) of conditioned floor area and multifamily buildings whose average unit size is less than 1,200 square feet (110 square meters) automatically meet the requirements of this credit.

J. EQ Credit 3.3 (option 3) – Balancing of H&C Distribution Systems - Pressure Balancing

1. Facilitate for Green Rater or a Third-Party to test each bedroom for pressure difference of more than 3 Pa (0.012-inch w.c.) with respect to the main body of the house when doors are closed, and the air handler is operating on highest speed.

K. EQ Credit 7 – Low Emitting Products

1. In the interior of the home, use products that have been tested and found compliant with the California Department of Public Health Standard Method V1.1–2010, using CA Section 01350, Appendix B, New Single-Family Residence Scenario, for emissions testing guidance. At least 90% of a component must meet the requirements to earn credit.
    a. For site-applied interior paints and coatings, meet the requirements of CA Section 01350.

TABLE 1. Acceptable certifications for emissions and content requirements

CERTIFICATION	TESTING STANDARD REFERENCED IN LEED	APPLICABLE CATEGORIES
SCS Indoor Advantage Gold	CDPH Standard Method v1.1 ANSI/BIFMA M7.1-2011	General Emissions Evaluation (many product categories), Furniture
FloorScore	CDPH Standard Method v1.1	Flooring
Carpet and Rug Institute (CRI) Green Label Plus	CDPH Standard Method v1.1	Carpeting, carpet padding, adhesives
Greenguard Children and Schools	CDPH Standard Method v1.1	General Emissions Evaluation (many product categories including exterior applied products)
Collaborative for High Performance Schools (CHPS)	CDPH Standard Method v1.1	General Emissions Evaluation (many product categories)
CARB ULEF label	N/A	Composite Wood

L. EQ Credit 8 – No Environmental Tobacco Smoke

1. Install No Smoking signage. Coordinate quantity and location with Owner, Management, and Architect. Signage should indicate no smoking is permitted within 25 feet of the building.
2. Any designated smoking areas should be greater than 25 feet from building entries, outdoor air intakes and operable windows.

ENCLOSURES

1. LEED for Homes Scorecard and Credit Categories
2. LEED v4 Multifamily Midrise Thermal Enclosure Checklist
3. Energy Star Water Management System Builder Checklist

END OF SECTION

LEED BD+C: Multifamily Midrise v4 - LEED v4

Scarborough Senior Housing Scorecard (ID:)

Project Address **, Scarborough Senior Housing, 494 St. Clair Ave. Columbus, OH**

Note: The information on this tab is READ-ONLY. To edit this information, see the Credit Category tabs.

Total		**Certification Level:**	**Not Certified**		**Verified**	19.6
Integrative Process		**Preliminary** Y	2 of 2	M *0*	**Verified**	0
IPc	**Integrative Process**		2 of 2	*0*		
Location and Transportation		**Preliminary** Y	11 of 15	M *1*	**Verified**	0
LTp	Floodplain Avoidance		Required			Not Verified
LTc	LEED for Neighborhood Development		0 of 15	*0*		
LTc	Site Selection		8 of 8	*0*		
LTc	Compact Development		2 of 3	*1*		
LTc	Community Resources		1 of 2	*0*		
LTc	Access to Transit		0 of 2	*0*		
Sustainable Sites		**Preliminary** Y	2 of 7	M *0*	**Verified**	0
SSp	Construction Activity Pollution Prevention		Required			Not Verified
SSp	No Invasive Plants		Required			Not Verified
SSc	Heat Island Reduction		0 of 2	*0*		
SSc	Rainwater Management		0 of 3	*0*		
SSc	Nontoxic Pest Control		2 of 2	*0*		
Water Efficiency		**Preliminary** Y	4 of 12	M *1*	**Verified**	0
WEp	Water Metering		Required			Not Verified
WEc	Total Water Use		0 of 12	*0*		
WEc	Indoor Water Use		4 of 6	*0*		
WEc	Outdoor Water Use		0 of 4	*1*		
Energy and Atmosphere		**Preliminary** Y	19.6 of 37	M *0*	**Verified**	19.6
EAp	Minimum Energy Performance		Required			Not Verified
EAp	Energy Metering		Required			Not Verified
EAp	Education of the Homeowner, Tenant or Building Manager		Required			Not Verified
EAc	Annual Energy Use		19.6 of 30	*0*		19.6
EAc	Efficient Hot Water Distribution System		0 of 5	*0*		
EAc	Advanced Utility Tracking		0 of 2	*0*		

Materials and Resources		**Preliminary**	Y	2.5 of 9	M	*1*	**Verified**	0
MRp	Certified Tropical Wood			Required				Not Verified
MRp	Durability Management			Required				Not Verified
MRc	Durability Management Verification			1 of 1		*0*		
MRc	Environmentally Preferable Products			1.5 of 5		*1*		
MRc	Construction Waste Management			0 of 3		*0*		
Indoor Environmental Quality		**Preliminary**	Y	7.5 of 18	M	*1.5*	**Verified**	0
EQp	Ventilation			Required				Not Verified
EQp	Combustion Venting			Required				Not Verified
EQp	Garage Pollutant Protection			Required				Not Verified
EQp	Radon-Resistant Construction			Required				Not Verified
EQp	Air Filtering			Required				Not Verified
EQp	Environmental Tobacco Smoke			Required				Not Verified
EQp	Compartmentalization			Required				Not Verified
EQc	Enhanced Ventilation			1 of 3		*0*		
EQc	Contaminant Control			0 of 2		*0.5*		
EQc	Balancing of Heating and Cooling Distribution Systems			2 of 3		*0*		
EQc	Enhanced Compartmentalization			0 of 3		*0*		
EQc	Combustion Venting			2 of 2		*0*		
EQc	Enhanced Garage Pollutant Protection			1 of 1		*0*		
EQc	Low-Emitting Products			0.5 of 3		*1*		
EQc	No Environmental Tobacco Smoke			1 of 1		*0*		
Innovation		**Preliminary**	Y	2 of 6	M	*0*	**Verified**	0
INp	Preliminary Rating			Required				Not Verified
INc	Innovation			1 of 5		*0*		
INc	LEED Accredited Professional			1 of 1		*0*		
Regional Priority		**Preliminary**	Y	3 of 4	M	*0*	**Verified**	0
RPc	Regional Priority			3 of 4		*0*		

Point Floors

The project earned at least 8 points total in Location and Transportation and Energy and Atmosphere	Yes
The project earned at least 3 points in Water Efficiency	No
The project earned at least 3 points in Indoor Environmental Quality	No

Total		**Preliminary**	Y	53.6 of 110	M	*4.5*	**Verified**	19.6

Certification Thresholds Certified: 40-49, Silver: 50-59, Gold: 60-79, Platinum: 80-110

Integrative Process

Preliminary Y **2** Maybe **0** **Verified** **0**

IP Credit Integrative Process

Up to 2 points
Exemplary Performance: Achieve all three options

Preliminary Y 2 M 0 **Verified** 0

Option 1. Integrative Project Team (1 point) Y M V

	Team members, in addition to the builder and verification team, include capabilities in at least three of the following skill sets: architecture or residential building design; mechanical or energy engineering; building science or performance testing; green building or sustainable design; and civil engineering, landscape architecture, habitat restoration, or land-use planning.
	All team members referenced above were involved in at least three of the following phases of the design and construction process: conceptual or schematic design; LEED planning; preliminary design; energy and envelope systems analysis or design; design development; and construction.
	Meetings were conducted with the project team at least monthly to review project status, introduce new team members to project goals, discuss problems, formulate solutions, review responsibilities, and identify next steps.

AND/OR
Option 2. Design Charrette (1 point) Y 1 M V

True	A full-day workshop (or two half-day workshops) was conducted with the project team, as defined in Option 1, no later than the design development phase.
11/21/2023	Date(s)
8	Duration

AND/OR
Option 3. Trades Training (1 point) Y 1 M V

True	At least eight hours of training on the green aspects of the project and how the trades can contribute to achieving each LEED for Homes prerequisite and attempted credit was conducted before construction but after trades have been hired for the project.
TBD	Date(s)
	Duration
	Trainer

Location and Transportation

Preliminary Y **11** Maybe **1** **Verified** **0**

LT Prerequisite Floodplain Avoidance

Required

Verified

Select one of the following:

True	The project is not built on land within a flood hazard area.
	The project is built on land within a flood hazard area and in accordance with flood provisions.
	The project is built on land within a flood hazard area and is a previously developed building and hardscape.

LT Credit LEED for Neighborhood Development

15 points

Preliminary Y M **Verified**

	Name of LEED for Neighborhood Development project
	LEED ND project ID number
	Rating system and version
	LEED ND certification date

LT Credit Site Selection

Up to 8 points **Preliminary** Y 8 M 0 **Verified** 0

Exemplary Performance: Earn all 9 points

Option 1. Sensitive Land Protection (3-4 points) Y 4 M 0 V 0

Path 1. Previously Developed (4 points) Y 4 M V

1.07	Total buildable land area (acre or sq ft)
1.07	Previously developed buildable land area (acre or sq ft)
100.00%	Percentage of lot previously developed (%)

OR

Path 2. Avoidance of Sensitive Land (3 points) Y M V

All new buildings, hardscapes, roads, or parking areas of the project are located on land that meets the following criteria:

	Does not consist of prime farmland, unique farmland, or farmland of statewide of local importance.
	Was not public parkland prior to acquisition.
	Is not in a flood hazard area shown on a legally adopted flood hazard map or otherwise legally designated by the local jurisdiction or state.
	Is not on land specifically identified as habitat for species listed in the U.S. Endangered Species Act; the state's endangered species act; NatureServe GH, G1, or G2 lists; or those listed under local equivalent standards (for projects outside the U.S.) that are not covered by NatureServe data.
	Is not on land within 50 ft (15 m) of wetlands or within the setback distance from wetlands prescribed by local, state or national regulations, whichever is more stringent.
	Is not on land within 100 ft (30 m) of water bodies, including seas, lakes, rivers, streams and tributaries.

AND/OR

Option 2. Infill Development (2 points) Y 2 M V

100%	Percent of land within a 1/2 mile (800 meters) from the project boundary that is previously developed

Alternatively, for projects within city limits of towns with populations less than 20,000

	Percent of land adjacent to the project boundary that is previously developed

AND/OR

Option 3. Open Space (1 point) Y 1 M V

Select one of the following:

Yes	Built within 1/2 mile (800 meters) of open space that is at least 3/4 acres (0.3 hectares)
	Create publicly available open space on the project site

AND/OR

Option 4. Street Network (1 point) Y 1 M V

	Qualifying intersection density (intersections per square mile)
90	

AND/OR

Option 5. Bicycle Network and Storage (1 point) Y M V

Bicycle Network

Select one of the following. The project has a functional entry and/or bicycle storage within 200 yd (180 m) of a bicycle network that connects to:

	At least 10 uses
	A school or employment center
	A bus rapid transit stops, rail stations, and/or ferry terminals

Bicycle Storage for Multifamily Buildings

	Number of building occupants
	Number of residential units
	Number of short-term spaces provided
4	Number of short-term spaces required
	Number of long-term spaces provided
0	Number of long-term spaces required

Bicycle Storage for Single Family Homes

	The project is a single family home with garage.

LT Credit Compact Development

Up to 3 points

Exemplary Performance for Single and Multifamily Lowrise Only: 35 DU/acre (86.5 DU/hectare)

Preliminary Y 2 M 1 **Verified**

1.07	Total project boundary area (acre)
1.07	Buildable land area (acre)
84	Number of dwelling units
78.50	DU/acre of buildable land

LT Credit Community Resources

Up to 2 points

Exemplary Performance: 16 uses for 1/2 point, 20 uses for 1 point.

Preliminary Y 1 M **Verified**

4	Number of community resources within a 1/2 mile (800 meters) walking distance

LT Credit Access to Transit

Up to 2 points

Exemplary Performance: For multiple transit types, 720 weekday trips and 432 weekend trips; For commuter rail or ferry, 120 weekday trips.

Preliminary Y M **Verified**

For projects with multiple transit types

36	Number of weekday trips
34	Number weekend day trips

For projects with commuter rail or ferry service only

	Number of weekday trips

Sustainable Sites

Preliminary Y **2** Maybe **0** **Verified** **0**

SS Prerequisite Construction Activity Pollution Prevention

Required

Verified

Confirm all of the following measures were implemented on the project, as applicable:

True	Stockpiled and protected disturbed topsoil from erosion.
True	Controlled the path and velocity of runoff with silt fencing or comparable measures.
True	Protected on-site storm sewer inlets, streams, and lakes with straw bales, silt fencing, silt sacks, rock filters, or comparable measures.
True	Provided swales to divert surface water from hillsides.
True	Used tiers, erosion blankets, compost blankets, filter socks, berms, or comparable measures to stabilize soils in any area with a slope of 15% (6.6:1) or more that was disturbed during construction.
True	Prevented air pollution from dust and particulate matter.

For construction sites larger than 1 acre

Select one of the following:

True	The project team created an implemented an Erosion and Sedimentation Control (ESC) plan that conforms to the requirements of the 2012 U.S. Environmental Protection Agency Construction General Permit (CGP).
	The project team created an implemented an Erosion and Sedimentation Control (ESC) plan that conforms to local standards and codes, which are as or more stringent than the 2012 EPA Construction General Permit (CGP).

SS Prerequisite No Invasive Plants

Required

Verified

True	No invasive plant species have been introduced into the landscape.

SS Credit Heat Island Reduction

Up to 2 points

Option 1. Shading and Option 2. Nonabsorptive Materials (1-2 points)

Preliminary Y M **Verified**

Hardscapes

	Area of shaded hardscapes (sq ft)
	Area of unshaded paving materials with an initial SR value of at least 0.33 (sq ft)
	Area of unshaded vegetation in open pavers (sq ft)
	Remaining hardscape area (not earning credit) (sq ft)
0	Total hardscape area (driveways, walkways, patios, etc.) (sq ft)

Roof

	Area of ENERGY STAR qualified roof (sq ft)

The ENERGY STAR roofing program had a sunset date effective June 1, 2022. Single family projects can use the LEED v4.1 Single Family pathway for 'High-Reflectance Roof. Use roofing materials that have an aged SRI equal to or greater than the values in Table 1. See the rating system for Table 1.' LEED v4 Multifamily projects can pursue the LEED v4.1 Multifamily credit substitution approach as outlined in the LEED v4.1 Guide.

	Area of vegetated roof (sq ft)
	Remaining roof area (not earning credit) (sq ft)
0	Total roof area (sq ft)
0%	Percentage of area with shading or nonabsorptive material (%)

SS Credit Rainwater Management

Up to 3 points | **Preliminary** Y 0 M 0 | **Verified** 0

Exemplary Performance: For Case 1, manage 100% of all stormwater on-site.

Case 1. Low Impact Development (1-3 points) Y M V

Site Characteristics

0	Total lot area (sq ft)

Roof

	Vegetated roof area (sq ft)
	Roof area directed to a qualifying infiltration feature (sq ft)
	Remaining roof area (not earning credit) (sq ft)
0	Total roof area (sq ft)

Non-roof Site Area

Softscape

	Total landscape softscape area (sq ft)

Hardscape

	Permeable paving (sq ft)
	Qualifying open pavers (sq ft)
	Hardscapes directed to qualifying infiltration features (sq ft)
	Remaining hardscape area (not earning credit) (sq ft)
0	Total hardscape area (driveways, walkways, patios, etc.) (sq ft)

Qualifying area, as a percentage of total lot area

0.0%	Qualifying area, as percentage of total lot area (%)

Reduction of total impermeable area

0	Total impermeable area of the project (sq ft)
#N/A	Reference home size (sq ft)
0.0%	Impermeable area as a percentage of reference home size

OR

Case 2. NPDES Projects (2-3 points) Y M V

	Percentile rainfall event

SS Credit Nontoxic Pest Control

Up to 2 points

Exemplary Performance: Projects that achieve 2 points can earn another ½ point for each additional strategy, up to a total of 1 point.

Preliminary	Y	2	M		**Verified**	

Select all of the following that have been included in the project.

	Install a steel mesh barrier termite control system. (1 point)
	Install a physical termite barrier system (e.g., basaltic rock) approved by code. (1 point)
Yes	For below-grade walls, use solid concrete foundation walls, masonry walls with a course of solid block bond beam, or concrete-filled block. (0.5 point)
	Install post-tension slabs. (0.5 point)
	Treat all cellulosic structural material (e.g., wood framing) with a registered pesticide containing borates, following the manufacturer's directions for preconstruction treatment. (0.5 point)
	Use noncellulosic material for all structural elements. (0.5 point)
	Install ports or openings for all plumbing elements that penetrate the slab, to allow access for inspection and treatment of pest infestations. (0.5 point)
	Install a registered termite bait system and provide for ongoing maintenance as required by the manufacturer. (0.5 point)
Yes	Design a minimum 6-inch (150 millimeters) inspection space between the surface of the planned landscape grade and nonmasonry siding. (0.5 point)
Yes	Seal all external cracks, joints, penetrations, edges, and entry points with appropriate caulking. Install rodent- and corrosion-proof screens (e.g., copper or stainless steel mesh) on all openings greater than ¼ inch (6 millimeters), except where code prohibits their installation. (0.5 point)
Yes	Design discharge points for rain gutters, air-conditioning condensation lines, steam vent lines, or any other moisture source such that discharge is at least 24 inches (600 millimeters) from the foundation. (0.5 point)
	Design landscape features to provide a minimum 18-inch (450 millimeters) space between the exterior wall and any plantings. (0.5 point)

For multifamily projects

Yes	Develop an integrated pest management policy. The policy must include guidance for residents on pesticide use, housekeeping and prompt reporting of pest problems and incorporate policy in the Homeowner Education Manual. (Required)

Water Efficiency

Preliminary Y **4** Maybe **1** **Verified** **0**

WE Prerequisite Water Metering

Required **Verified**

OR
Case 2. Multifamily V

	A water meter or submeter is installed for each unit.
True	A water meter or submeter is installed for the whole building.

WE Credit Total Water Use

Up to 12 points

Exemplary Performance: 70% reduction of indoor and outdoor water consumption

Preliminary Y M **Verified**

0.00%	Total reduction of indoor and outdoor water consumption as calculated in the Water Reduction Calculator (%)

For single family projects

	The water pressure does not exceed 60 psi (415 kPa). There are no detectable water leaks. Any installed water softeners are demand initiated.

For multifamily projects

	There are no detectable water leaks. Any installed water softeners are demand initiated.

WE Credit Indoor Water Use

Up to 6 points **Preliminary** Y 4 M 0 **Verified** 0

OR
Case 2. Multifamily and Midrise Y 4 M V

True	There are no detectable water leaks.

Note: No additional credit is awarded if the fixtures and fittings in non-unit spaces are more efficient than those of in-unit spaces.

Meet any of the following for in-unit spaces and non-unit spaces:

Lavatory Faucet (1-2 points)

True	All installed lavatory faucets and/or faucet aerators are WaterSense labeled.
1.00	Average rated flow volume across all lavatory faucets (gpm)

Showerheads (1-2 points)

True	All installed showerhead fixtures and fittings are WaterSense labeled.
1.50	Average rated flow volume per shower compartment (gpm)

Toilets (1 point)

	All installed toilet fixtures and fittings are WaterSense labeled.
	Average rated flush volume across all toilets (gpf)

Clothes Washers (1 point)

	All clothes washers are ENERGY STAR qualified or performance equivalent

WE Credit Outdoor Water Use

Up to 4 points

Preliminary Y M 1 **Verified**

	Turf grass area as a percentage of total landscape softscape area (%)
	Native or adapted plant area as a percentage of total landscape softscape area (%)

Energy and Atmosphere

Preliminary Y **19.6** Maybe **0** **Verified** **19.6**

EA Prerequisite Minimum Energy Performance

Required

1. ENERGY STAR for Homes version 3 **Verified**

Whole-Building Energy Simulation

	Target Finder (Optional). Enter energy performance rating target (kBtu/sq ft per year)
True	The project meets the mandatory requirements of ASHRAE 90.1-2010, Sections 5.4, 6.4, 7.4, 8.4, 9.4 and 10.4
18%	Total energy cost savings (%)
No	Is the project pursuing LI 10491?

Commissioning **Verified**

Option 1. Commissioning using ENERGY STAR Protocols. V

	The project meets the ENERGY STAR Qualified Multifamily High Rise Buildings Testing and Verification Protocols.

OR

Option 2. Commissioning using Prescriptive Path V

1. Reduced Heating and Cooling Distribution System Losses for In-Unit HVAC

True	Duct leakage rate does not exceed 4.0 cfm25 per 100 sq ft (1.2 cmm at 25 Pa per 100 sq m) of conditioned floor area.
True	Duct leakage rate in units smaller than 1,200 sq ft (110 sq m) does not exceed 6.0 cfm25 per 100 sq ft (1.7 cmm at 25 Pa per 100 sq m) of conditioned floor area.
True	Total duct leakage rate in-units systems does not exceed 8.0 cfm25 per 100 sq ft (2.4 cmm at 25 Pa per 100 sq m) of conditioned floor area.
	The air-handler unit and ductwork are visibly within the unit's envelope.

2. Fundamental Commissioning of Central HVAC Systems

True	The project meets the performance testing and ongoing maintenance requirements of LEED v4 New Construction EA Prerequisite Fundamental Commissioning and Verification for central commercial heating, cooling, water heating and ventilation systems.

3. Construction Document Specifications

True	The following details were included in the bid documents: Elements to be sealed, air barrier sheet and compartmentalization sheet.

4. LEED for Homes Multifamily Midrise Thermal Enclosure Inspection Checklist

True	The LEED for Homes Multifamily Midrise Thermal Enclosure Inspection Checklist has been completed.
	The project is a certified Passive House project.

EA Prerequisite Energy Metering

Required **Verified**

OR

Case 2. Multifamily V

True	Electric submeters are installed in each residential unit.
Whole building	A whole-building gas meter or submeter for each residential unit is installed.

EA Prerequisite Education of Homeowner, Tenant, or Building Manager

Required

Verified

True	An operations and maintenance manual, binder, or CD has been/will be provided to all individuals or organizations responsible for the maintenance of the home.
True	A minimum one-hour walkthrough of the home with the occupants has been conducted.

EA Credit Annual Energy Use

Up to 30 points

Exemplary Performance: 65% or better reduction from ASHRAE 90.1-2010.

Preliminary Y 19.6 M V 19.6

18%	Percent reduction from ASHRAE 90.1-2010
13	Points earned
6.6	Average home size point adjustment (from the Multifamily HSA tab)
19.6	Final points earned

EA Credit Efficient Hot Water Distribution System

Up to 5 points **Preliminary** Y 0 M 0 **Verified** 0

Option 1. Efficient Hot Water Distribution (2 points) Y 0 M 0 V 0

Note: Projects using heat traces that serve a single unit or house are awarded only half credit.

*For projects using circulating systems (required for both Path 1 **AND** Path 2 below)*

	Circulating pump does not operate continuously, is on a timer, or is on a water temperature sensor.
	Circulating pump is demand activated by a momentary contact switch, motion sensor, flow switch, door switch or voice command.
	After the pump starts, the controls allow the pump to operate until the water temperature in the return pipe rises not more than 10ºF (6 ºC) above the initial temperature of the water in the pipe. Controls limit the water temperature to a maximum of 105ºF (40 ºC). Controls limit pump operation to not more than 5 minutes per activation in the event that both means of shutting off the pump have failed.
	Circulating hot water systems have with an automatic or readily accessible manual switch to turn off the hot water circulating pump when not in use.

For projects using heat-traced piping systems

	Piping is insulated.

Path 1. Maximum Allowable Pipe Length (2 points) Y M V

	Pipe or tube length installed (ft)
	Nominal pipe size (in)
	Maximum pipe or tube length allowed for water heaters, boilers with no circulation loop or heat traced pipe or in multifamily buildings a central circulation loop or heat traced pipe (ft)
	Maximum pipe or tube length allowed for circulation loop or heat traced pipe serving a single unit or house (ft)

OR

Path 2. Maximum Allowable Pipe Volume (2 points) Y M V

	Volume of hot or tempered water from source to termination (oz)

OR

Option 2. Performance Test (3 points) Y 0 M 0 V 0

Note: Projects using heat traces that serve a single unit or house are awarded only half credit.

*For projects using circulating systems (required for both Case 1 **AND** Case 2 below)*

- Circulating pump does not operate continuously, is on a timer, or is on a water temperature sensor.
- Circulating pump is demand activated by a momentary contact switch, motion sensor, flow switch, door switch or voice command.
- After the pump starts, the controls allow the pump to operate until the water temperature in the return pipe rises not more than 10ºF (6 ºC) above the initial temperature of the water in the pipe. Controls limit the water temperature to a maximum of 105ºF (40 ºC). Controls limit pump operation to not more than 5 minutes per activation in the event that both means of shutting off the pump have failed.
- Circulating hot water systems have with an automatic or readily accessible manual switch to turn off the hot water circulating pump when not in use.

For projects using heat-traced piping systems

- Piping is insulated.

Case 1. Hot water source is a water heater or boiler with no circulation loop or heat traced pipe; or in multifamily buildings a central circulation loop or heat traced pipe. Y M V

- Meets WaterSense Labeled New Homes requirements

OR

- Tested volume of water stored in piping (gal)

OR

Case 2. Hot water source is a circulation loop or heat traced pipe serving a single unit or house Y M V

- Tested volume of water stored in piping (gal)

AND/OR

Y M V

Option 3. Pipe Insulation (2 points)

- Insulation R-value

EA Credit Advanced Utility Tracking

Up to 2 points **Preliminary** Y 0 M 0 **Verified** 0

Exemplary Performance: Meter separate energy usage information for at least four end uses.

Case 2. Multifamily Y 0 M 0 V 0

Option 1. Electric and Water (1 point) Y M V

Select one of the following:

- A permanent energy-monitoring system that records at intervals of one hour or less has been installed in each unit.
- The project has an automatic in-ground irrigation system and landscaped irrigated area larger than 1,000 sq ft (93 sq m) and has installed a submeter to monitor all irrigation system components.

AND/OR

Option 2. Third-Party Utility Reporting (1 point) Y 0 M 0 V 0

Path 1. Whole-Building Master Meter Y M V

- The building owner has shared all applicable utility data with USGBC via a USGBC-approved third-party.

OR

Path 2. Individual Unit Meters Y M V

- At least 50% of unit owners or occupants have shared all applicable utility data with USGBC via a USGBC-approved third-party.

Materials and Resources

Preliminary Y **2.5** Maybe **1** **Verified** **0**

MR Prerequisite Certified Tropical Wood

Required

Verified

True	All wood in the building is nontropical, reused or reclaimed, or certified by the Forest Stewardship Council, or USGBC-approved equivalent.

MR Prerequisite Durability Management

Required

Verified

True	ENERGY STAR for Homes, version 3, water management system checklist is collected from builder.

Confirm all of the following have been implemented on the project:

True	Nonpaper-faced backer board, or a product or coating over wallboard that meets standard ASTM D 3273 standard, was installed on the area above bathtub, spa or shower, and in areas behind fiberglass enclosures where wallboard is installed.
True	Water-resistant flooring was installed in the kitchen, bathroom(s), laundry room, spa area(s). No carpet was installed in these areas.
True	Water-resistant flooring was installed in entryways within 3 feet of exterior door(s).
True	A drain and drain pan, drain pan and automatic water shut-off or flow restrictors, or floor drain with floor sloped to drain was installed for all tank water heaters in or over living space.
True	A braided washer hose, drain and drain pan, drain pan and automatic water shut-off or flow restrictors, or floor drain with floor sloped to drain was installed for clothes washer in or over living space.
True	Conventional clothes dryers exhaust directly to outdoors.

MR Credit Durability Management Verification

1 point

Preliminary Y 1 M **Verified**

True	Each measure in the ENERGY STAR for Homes, version 3, water management system builder checklist was verified by the verification team.

MR Credit Environmentally Preferable Products

Up to 5 points **Preliminary** Y 1.5 M 1 **Verified** 0

Exemplary Performance: For Option 2, achieve a minimum of 4 points to earn another 2 points for purchasing products that meet the requirements.

Option 1. Local Production **Preliminary** Y 0.5 M **Verified**

Select which the following were extracted, processed, and manufactured within 100 miles (160 km) of the project site:

	Percentage of locally produced framing (%) (0.5 point)
100.00	Percentage of locally produced aggregate for concrete and foundation (%) (0.5 point)
	Percentage of locally produced drywall and interior sheathing (%) (0.5 point)

AND/OR

Option 2. Environmentally Preferable Products **Preliminary** Y 1 M 1 **Verified**

Select the criteria met by at least 90% of the component:

No Floor Covering (2 points)	
Floor Covering (1 point)	
Insulation (1 point)	At least 25% postconsumer or 50% preconsumer recycled content
	Maybe
Sheathing (1 point)	
Framing (1 point)	
Drywall (1 point)	For synthetic, 95% recycled content (pre-, post-, or combination)
	For non-synthetic, 10% post-consumer recycled content
Concrete (1 point)	
Roofing (1 point)	
Siding (1 point)	

Select criteria met for at least 3 of the following additional components by at least 90% of the component (1 point):

Doors	
Cabinets	
Counters	
Interior Trim	
Decking/Patio	
Windows	

MR Credit Construction Waste Management

Up to 3 points

Exemplary Performance: For renovation projects, track and divert at least 50% of demolition waste.

Preliminary Y M **Verified**

	LEED Reference Home Baseline Waste (lbs)
	Total Construction Waste (including recycled waste) (lbs)
	Recycled Waste (lbs)
0.00	Project Construction Waste (lbs)
	Percent reduction below baseline (%)

Indoor Environmental Quality

Preliminary Y **7.5** Maybe **1.5** **Verified** **0**

EQ Prerequisite Ventilation

Required **Verified**

OR

Case 2. Multifamily V

Local Exhaust

Confirm all of the following have been implemented on the project:

True	Local exhaust systems meeting the requirements of ASHRAE Standard 62.2–2010, Sections 5 and 7 or local equivalent, whichever is more stringent, were installed in all bathrooms (including half-baths) and the kitchen.
True	Local exhaust systems exhaust air directly to the outdoors.
True	All bathroom exhaust fans are ENERGY STAR-labeled or an HRV or ERV is used.
True	For exhaust hood systems capable of exhausting in excess of 400 cubic feet per minute (188 liters per second), makeup air is provided at a rate approximately equal to the exhaust air rate. Makeup air systems have a means of closure and can be automatically controlled to start and operate simultaneously with the exhaust system.

Whole Unit Mechanical Ventilation

True	The project meets ASHRAE Standard 62.2-2010 Sections 4 and 7 or local equivalent, whichever is more stringent.

Non-Unit Spaces

True	The project meets the minimum requirements of ASHRAE Standard 62.1-2010 Sections 4 -7 or local equivalent, whichever is more stringent.
	The project is located in a nonattainment area for PM2.5. The project has installed MERV 11 or higher filters.
	The project is located in a nonattainment area for ozone.

EQ Prerequisite Combustion Venting

Required

Verified

	The project has earned the EPA Indoor airPLUS label

OR

True	No unvented combustion appliances were installed (ovens and ranges excluded).
True	A carbon monoxide (CO) monitor is installed on each floor, hard-wired with a battery backup.

For projects with fireplaces or woodstoves installed

N/A	Provide doors that close or a solid glass enclosure.
N/A	Closed-combustion, power-vented or passes BPI or RESNET combustion safety protocols

For projects where space and water heating equipment involving combustion are installed

Select one of the following:

	Equipment is installed with closed combustion (i.e. sealed supply air and exhaust ducting)
True	Equipment is installed with power-vented exhaust
	Equipment is located in a detached utility building or open-air facility

EQ Prerequisite Garage Pollutant Protection

Required

Verified

	The project has earned the EPA Indoor airPLUS label
	OR
True	All air-handling equipment and ductwork is placed outside the fire-rated envelope of the garage.
True	Shared surfaces between the garage and conditioned spaces are tightly sealed.

Conditioned Spaces Above Garage

N/A	All penetrations and all connecting floor and ceiling joist bays are sealed.

Conditioned Spaces Next to Garage

N/A	All doors are weather-stripped.
N/A	Carbon monoxide detectors are installed in rooms that share a door with the garage.
N/A	All penetrations and all cracks at the base of the walls are sealed.

EQ Prerequisite Radon-Resistant Construction

Required **Verified**

Exemplary Performance: For projects in radon zones 2 and 3, install a qualifying passive radon ventilation system.

EPA Indoor airPLUS label V

	The project has earned the EPA Indoor airPLUS label

OR

Case 1. New Construction V

1	EPA radon zone

For projects in EPA radon zone 1

True	There is a capillary break per the Indoor airPLUS specifications.
True	An electrical outlet has been provided near vent piping in the attic to facilitate future fan installation.
True	A gas-tight vertical vent pipe extending up through the conditioned spaces and terminating above the roof opening has been installed.
	OR
	The house is elevated by at least 2 feet (600 millimeters) with open air space between building and ground or there is a garage under the building.

OR

Case 2. Renovation of Existing Building V

	EPA radon zone

For renovation projects in EPA radon zone 1 with no slab work being performed

	Radon test results (pCi/L)
	If results are greater than 4 pCi/L, an active ventilation system has been installed.

EQ Prerequisite Air Filtering

Required

Verified

	The project has earned the EPA Indoor airPLUS label
	OR
8	MERV rating of filters on recirculating space conditioning systems
8	MERV rating of filters on mechanically supplied outdoor air systems with 10 ft (3 m) or more of ductwork

EQ Prerequisite Environmental Tobacco Smoke

Required

Verified

For multifamily projects

True	Smoking is prohibited in all common areas of the building.
True	Smoking is prohibited outside the project building(s) except in designated smoking areas located at least 25 ft (7.5 m) from all entries, outdoor air intakes, and operable windows.
True	Signage communicating the smoking policy has been installed.

EQ Prerequisite Compartmentalization

Required

Verified

For multifamily and attached single-family projects

True	Each residential unit has sealed penetrations through walls, ceilings, and floors and vertical chases adjacent to units.
True	All doors in the residential units leading to common hallways have weather-stripping.
True	All exterior doors and operable windows have weather-stripping.
	Blower door test results (cfm50)
	Envelope enclosure area (sq ft)
0.00	Leakage per area of enclosure (cfm50/sq ft)

EQ Credit Enhanced Ventilation

Up to 3 points **Preliminary** Y 1 M 0 **Verified** 0

Option 1. Enhanced Local Exhaust (1 point) Y 1 M V

continuously operating exhaust fan	Bathroom exhaust fan control type in every bathroom with a shower, bathtub, or spa

AND/OR

Option 2. Enhanced Whole-House Ventilation (2 points) Y M V

	A balanced whole-house ventilation system was designed and installed that meets ASHRAE 62.2-2010 sections 4 and 7 in each home or unit.
	The system does not exceed ASHRAE 62.2-2010 requirements by more than 10%.

EQ Credit Contaminant Control

Up to 2 points **Preliminary** Y 0 M 0.5 **Verified** 0

Exemplary Performance: Achieve a minimum of 2 1/2 points to earn another 1/2 point.

Option 1. Walk-off Mats (0.5 point) Y M V

	For all primary entryways, a permanent walk-off mat that is at least 4 feet (1.2 meters) long and allows access for cleaning has been installed.

For multifamily projects

	For exterior entryways in common areas, permanent systems that are at least 10 feet (3 meters) long have been installed.

AND/OR

Option 2. Shoe Removal and Storage (0.5 point) Y M V

	A shoe removal and storage space is near the primary entryway.
	No conventional carpet is installed in shoe removal and storage area.

AND/OR
Option 3. Preoccupancy Flush (0.5 point) Y M 0.5 V

The project has earned the EPA Indoor airPLUS label

OR

True At installation, all permanent ducts and vents were sealed to minimize contamination from construction.

After construction ends and before occupancy

True Any dust and debris was removed from ducts.

True The home was flushed out for 48 hours, with all windows open, a fan run continuously or all HVAC fans and exhaust fans.

AND/OR
Option 4. Air Testing (1 point) Y M V

The building was tested for indoor air contaminants and maximum concentrations were not exceeded.

EQ Credit Balancing of Heating and Cooling Distribution Systems

Up to 3 points **Preliminary** Y 2 M 0 **Verified** V 0

Case 1. Forced-Air Systems Y 2 M 0 V 0

Option 1. Multiple Zones (1 point) Y 1 M V

A system with at least two space-conditioning zones with independent thermostatic controls has been installed.

OR

True The project is a single family home less than 800 sq ft (74 sq m) or a multifamily building whose average unit size is less than 1,200 sq ft (110 sq m).

AND/OR
Option 2. Supply Air-Flow Testing (1 point) Y M V

The supply air-flow rates are within +/- 20% (or +/- 25 cfm or 11 lps) of calculated values from ACCA Manual J.

AND/OR
Option 3. Pressure Balancing (1 point) Y 1 M V

True The pressure differential between bedroom and rest of the house is less than 3 Pa.

OR
Case 2. Radiative Systems Y 0 M 0 V 0

Option 1. Multiple Zones (1 point) Y M V

A system with at least two zones with independent thermostatic controls has been installed

Each zone has a separate loop and pump controlled automatically by a thermostat control.

OR

The project is a single family home less than 800 sq ft (74 sq m) or a multifamily building whose average unit size is less than 1,200 sq ft (110 sq m).

AND/OR
Option 2. Room-by-Room Controls (2 points) Y M V

Room-by-room thermostatic controls are installed.

EQ Credit Enhanced Compartmentalization

3 points

Preliminary Y M **Verified**

0.00 Leakage per area of enclosure (cfm50/sq ft)

EQ Credit Enhanced Combustion Venting

Up to 2 points **Preliminary** Y 2 M 0 **Verified** 0

Option 1. No Fireplace or Woodstove (2 points) Y 2 M V

True No fireplaces or woodstoves have been installed.

OR

Option 2. Enhanced Combustion Venting Measures (1 point) Y M V

The project has earned the EPA Indoor airPLUS label

OR

EPA qualified wood- or pellet-burning fireplaces with either power or direct venting have been installed.

A natural gas, propane, or alcohol stove approved by a safety testing facility and has power or direct venting has been installed.

A natural gas, propane, or alcohol stove has a permanently fixed glass front or gasketed door and an electronic pilot.

EQ Credit Enhanced Garage Pollutant Protection

1 point **Preliminary** Y 1 M 0 **Verified** 0

Option 1. Exhaust Fan on Controls in Garage (1 point) Y M V

All of the requirements in ASHRAE 62.1-2010 for garage ventilation have been met.

The garage has sufficient exhaust to create negative pressure with respect to adjacent spaces with the doors to the garage closed.

Self-closing doors have been installed. Deck-to-deck partitions or a hard lid ceiling have been installed.

The exhaust fan either runs continuously or is on a carbon monoxide sensor that turns on the fan when ambient CO levels reach 35 ppm.

OR

Option 2. Detached Garage or No Garage or Carport (1 point) Y 1 M V

True No garage has been constructed.

A detached garage has been constructed

EQ Credit Low-Emitting Products

Up to 3 points

Preliminary Y 0.5 M 1 **Verified**

Select all that apply. At least 90% of a component must meet the requirement:

True	Site-applied interior paints and coatings have been tested and meet the requirements of CA Section 01350. (0.5 point)
Maybe	Flooring has been tested and meets the requirements of CA Section 01350. (0.5 point)
Maybe	Insulation has been tested and meets the requirements of CA Section 01350. (0.5 point)
	Site-applied adhesives and sealants have been tested and meet the requirements of CA Section 01350. (0.5 point)
	Composite wood products have been tested and meet the California Air Resources Board requirements for ultra-low-emitting formaldehyde (ULEF) resins or no-added formaldehyde based resins. (1 point)

EQ Credit No Environmental Tobacco Smoke

1 point

Preliminary Y 1 M **Verified**

True	Smoking is prohibited throughout the building, including within living units.
True	The prohibition is communicated to tenants through building rental or lease agreements or in condo or co-op association covenants. Restrictions and provisions for enforcement are also included.

Innovation

Preliminary Y **2** Maybe **0** **Verified** **0**

IN Prerequisite Preliminary Rating

Required

Verified

True — Preliminary rating and meeting are complete.

IN Credit Innovation

To achieve all five innovation points, a project team must achieve at least one pilot credit, at least one innovation credit and no more than two exemplary performance

Up to 5 points **Preliminary** Y 1 M 0 **Verified** 0

Option 1. Innovation (1 point) Y 1 M V

Describe the intent of the proposed innovation credit.

Affordable Housing

AND/OR

Option 2. Pilot (1 point) Y M V

Pilot credit name

AND/OR

Option 3. Additional Strategies (0.5-3 points) Y M V

Exemplary Performance: 1-2 points

Strategy / Credit name

Strategy / Credit name

Strategy / Credit name

Strategy / Credit name

Strategy / Credit name

Strategy / Credit name

IN Credit LEED Accredited Professional

1 point

Preliminary Y 1 M **Verified**

Jon Holway — Name of credential holder

Regional Priority

Preliminary Y **3** Maybe **0** **Verified** **0**

RP Credit Regional Priority

Up to 4 points

Preliminary Y 3 M **Verified**

Regional priority credits may be found on www.usgbc.org/rpc.

Regional Priority Credit Name	Required Threshold
Heat island reduction	2
Advancded Utility Tracking	1
Durability Management Verfication - YES	1
Rainwater Management	2
Site Selection - YES	4
Annual Energy Use - YES	13

LEED v4 Multifamily Midrise Thermal Enclosure Checklist

This document is based off of the ENERGY STAR Certified Homes, Version 3 / 3.1 (Rev. 8) Rater Field Checklist. Project teams may elect to use that document, and complete sections 1.3, 2 and 4. Consult that document for further clarifications, including numerous footnote that provide details and alternative compliance paths.

Thermal Enclosure System	Must Correct	Builder Verified	Rater Verified	N/A
1. High-Performance Fenestration & Insulation				
1.3 All insulation achieves RESNET-defined Grade I installation.	☐	☐	☐	-
2. Fully-Aligned Air Barriers At each insulated location below, a complete air barrier is provided that is fully aligned as follows:				
Ceilings: At interior or exterior horizontal surface of ceiling insulation in Climate Zones 1-3; at interior horizontal surface of ceiling insulation in Climate Zones 4-8.				
2.1 Dropped ceilings / soffits below unconditioned attics, and all other ceilings	☐	☐	☐	☐
Walls: At exterior vertical surface of wall insulation in all climate zones; also at interior vertical surface of wall insulation in Climate Zones 4-8				
2.2 Walls behind showers, tubs, staircases, and fireplaces	☐	☐	☐	☐
2.3 Attic knee walls and skylight shaft walls	☐	☐	☐	☐
2.4 Walls adjoining porch roofs or garages	☐	☐	☐	☐
2.5 Double-walls and all other exterior walls	☐	☐	☐	-
Floors: At exterior vertical surface of floor insulation in all climate zones and, if over unconditioned space, also at interior horizontal surface including supports to ensure alignment.				
2.6 Floors above garages, floors above unconditioned basements or crawlspaces, and cantilevered floors	☐	☐	☐	☐
2.7 All other floors adjoining unconditioned space (e.g., rim / band joists at exterior wall or at porch roof)	☐	☐	☐	☐
4. Air Sealing (Unless otherwise noted below, "sealed" indicates the use of caulk, foam, or equivalent material)				
4.1 Ducts, flues, shafts, plumbing, piping, wiring, exhaust fans, & other penetrations to unconditioned space sealed, with blocking / flashing as needed	☐	☐	☐	-
4.2 Recessed lighting fixtures adjacent to unconditioned space ICAT labeled and gasketed. Also, if in insulated ceiling without attic above, exterior surface of fixture insulated to ≥ R-10 in CZ 4-8.	☐	☐	☐	☐
4.3 Above-grade sill plates adjacent to conditioned space sealed to foundation or sub-floor. Gasket also placed beneath above-grade sill plate if resting atop concrete / masonry & adjacent to cond. space	☐	☐	☐	☐
4.4 Continuous top plate or blocking is at top of walls adjoining unconditioned space, and sealed	☐	☐	☐	☐
4.5 Drywall sealed to top plate at all unconditioned attic / wall interfaces using caulk, foam, drywall adhesive (but not other construction adhesives), or equivalent material. Either apply sealant directly between drywall and top plate or to the seam between the two from the attic above.	☐	☐	☐	☐
4.6 Rough opening around windows & exterior doors sealed	☐	☐	☐	-
4.7 Walls that separate attached garages from occupiable space sealed and, also, an air barrier installed and sealed at floor cavities aligned with these walls	☐	☐	☐	☐
4.8 In multifamily buildings, the gap between the common wall (e.g. the drywall shaft wall) and the structural framing between units sealed at all exterior boundaries	☐	☐	☐	☐
4.9 Doors adjacent to unconditioned space (e.g., attics, garages, basements) or ambient conditions made substantially air-tight with weatherstripping or equivalent gasket	☐	☐	☐	☐
4.10 Attic access panels, drop-down stairs, & whole-house fans equipped with durable ≥ R-10 cover that is gasketed (i.e., not caulked). Fan covers either installed on house side or mechanically operated.	☐	☐	☐	☐

ENERGY STAR Certified Homes, Version 3 (Rev. 07)
Water Management System Builder Checklist [1,2]

Home Address: _____ City: _____ State: _____ Zip Code: _____

1. Water-Managed Site and Foundation	Must Correct	Builder Verified	Rater Verified	N/A
1.1 Patio slabs, porch slabs, walks, and driveways sloped ≥ 0.25 in. per ft. away from home to edge of surface or 10 ft., whichever is less. [3]	☐	☐	☐	☐
1.2 Back-fill has been tamped and final grade sloped ≥ 0.5 in. per ft. away from home for ≥ 10 ft. See Footnote for alternatives. [3]	☐	☐	☐	☐
1.3 Capillary break beneath all slabs (e.g., slab on grade, basement slab) except crawlspace slabs using either: ≥ 6 mil polyethylene sheeting, lapped 6-12 in., or ≥ 1 in. extruded polystyrene insulation with taped joints. [4, 5, 6]	☐	☐	☐	☐
1.4 Capillary break at all crawlspace floors using ≥ 6 mil polyethylene sheeting, lapped 6-12 in., & installed using one of the following opt's: [4, 5, 6]				
1.4.1 Placed beneath a concrete slab; OR,	☐	☐	☐	☐
1.4.2 Lapped up each wall or pier and fastened with furring strips or equivalent; OR,	☐	☐	☐	☐
1.4.3 Secured in the ground at the perimeter using stakes.	☐	☐	☐	☐
1.5 Exterior surface of below-grade walls of basements & unvented crawlspaces finished as follows: a) For poured concrete, masonry, & insulated concrete forms, finish with damp-proofing coating. [7] b) For wood framed walls, finish with polyethylene and adhesive or other equivalent waterproofing.	☐	☐	☐	☐
1.6 Class 1 vapor retarder not installed on interior side of air permeable insulation in ext. below-grade walls. [8]	☐	☐	☐	☐
1.7 Sump pump covers mechanically attached with full gasket seal or equivalent.	☐	☐	☐	☐
1.8 Drain tile installed at the exterior side of footings of basement and crawlspace walls, with the top of the drain tile pipe below the bottom of the concrete slab or crawlspace floor. Drain tile surrounded with ≥ 6 in. of ½ to ¾ in. washed or clean gravel and with gravel layer fully wrapped with fabric cloth. Drain tile level or sloped to discharge to outside grade (daylight) or to a sump pump. [9]	☐	☐	☐	☐
2. Water-Managed Wall Assembly				
2.1 Flashing at bottom of exterior walls with weep holes included for masonry veneer and weep screed for stucco cladding systems, or equivalent drainage system. [10]	☐	☐	☐	☐
2.2 Fully sealed continuous drainage plane behind exterior cladding that laps over flashing in Item 2.1 and fully sealed at all penetrations. Additional bond-break drainage plane layer provided behind all stucco and non-structural masonry cladding wall assemblies. [10, 11]	☐	☐	☐	☐
2.3 Window and door openings fully flashed. [12]	☐	☐	☐	☐
3. Water-Managed Roof Assembly				
3.1 Step and kick-out flashing at all roof-wall intersections, extending ≥ 4" on wall surface above roof deck and integrated shingle-style with drainage plane above; boot / collar flashing at all roof penetrations. [13]	☐	☐	☐	☐
3.2 For homes that don't have a slab-on-grade foundation and do have expansive or collapsible soils, gutters & downspouts provided that empty to lateral piping that discharges water on sloping final grade ≥ 5 ft. from foundation, or to underground catchment system not connected to the foundation drain system that discharges water ≥ 10 ft. from foundation. See Footnote for alternatives & exemptions. [4, 14]	☐	☐	☐	☐
3.3 Self-sealing bituminous membrane or equivalent at all valleys & roof deck penetrations. [4]	☐	☐	☐	☐
3.4 In 2009 IECC Climate Zones 5 & higher, self-sealing bituminous membrane or equivalent over sheathing at eaves from the edge of the roof line to > 2 ft. up roof deck from the interior plane of the exterior wall. [4]	☐	☐	☐	☐
4. Water-Managed Building Materials				
4.1 Wall-to-wall carpet *not* installed within 2.5 ft. of toilets, tubs, and showers.	☐	☐	☐	☐
4.2 Cement board or equivalent moisture-resistant backing material installed on all walls behind tub and shower enclosures composed of tile or panel assemblies with caulked joints. Paper-faced backerboard shall not be used. [15]	☐	☐	☐	☐
4.3 In Warm-Humid climates, Class 1 vapor retarders not installed on the interior side of air permeable insulation in above-grade walls, except at shower and tub walls. [8]	☐	☐	☐	☐
4.4 Building materials with visible signs of water damage or mold *not* installed or allowed to remain. [16]	☐	☐	☐	☐
4.5 Framing members & insulation products having high moisture content *not* enclosed (e.g., with drywall) [17]	☐	☐	☐	☐

Builder Employee: _____

Builder Signature: _____ Date: _____

Builder has completed Builder Checklist in its entirety, except for items that are checked in the Rater Verified column (if any) [2]

Rater Signature: _____ Date: _____

Notes:

1. The specifications in this Checklist are designed to help improve moisture control in new homes compared with homes built to minimum code. However, these features alone cannot prevent all moisture problems. For example, leaky pipes or overflowing sinks or baths can lead to moisture issues and negatively impact the performance of this Checklist's specified features.

2. Upon completion, the builder shall return the Checklist to the Rater for review. Alternatively, at the discretion of the builder and Rater, the Rater may verify any item on this Checklist. When this occurs, the Rater shall check the box of the verified Items in the Rater Verified column. The Rater is only responsible for ensuring that the builder has completed the Builder Checklist in its entirety and for verifying the items that are checked in the Rater Verified column (if any). The Rater is not responsible for assessing the accuracy of the field verifications for items in this Checklist that are not checked in the Rater Verified column. Instead, it is the builder's exclusive responsibility to ensure the design and installation comply with the Checklist.
3. Swales or drains designed to carry water from foundation are permitted to be provided as an alternative to the slope requirements for any home, and shall be provided for a home where setbacks limit space to less than 10 ft. Also, tamping of back-fill is not required if either: proper drainage can be achieved using non-settling compact soils, as determined by a certified hydrologist, soil scientist, or engineer; OR, the builder has scheduled a site visit to provide in-fill and final grading after settling has occurred (e.g., after the first rainy season).
4. Not required in Dry (B) climates as shown in 2009 IECC Figure 301.1 and Table 301.1.
5. Not required for raised pier foundations with no walls. To earn the ENERGY STAR, EPA recommends, but does not require, that radon-resistant features be included in homes built in EPA Radon Zones 1, 2 & 3. For more information, see www.epa.gov/indoorairplus.
6. For an existing slab (e.g., in a home undergoing a gut rehabilitation), in lieu of a capillary break beneath the slab, a continuous and sealed Class I or Class II Vapor Retarder (per Footnote 8) is permitted to be installed on top of the entire slab. In such cases, up to 10% of the slab surface is permitted to be exempted from this requirement (e.g., for sill plates). In addition, for existing slabs in occupiable space, the Vapor Retarder shall be, or shall be protected by, a durable floor surface. If Class I Vapor Retarders are installed, they shall not be installed on the interior side of air permeable insulation or materials prone to moisture damage.
7. Interior surface of existing below-grade wall (e.g., in a home undergoing a gut rehab.) listed in Item 1.5a is permitted to be finished by:
   - Installing a continuous and sealed drainage plane, capillary break, Class I Vapor Retarder (per Footnote 8) and air barrier that terminates into a foundation drainage system as specified in Item 1.8; OR
   - If a drain tile is not required as specified in Footnote 9, adhering a capillary break and Class I Vapor Retarder (per Footnote 6) directly to the wall with the edges taped/sealed to make it continuous.

   Note that no alternative compliance option is provided for existing below-grade wood-framed walls in Item 1.5b.
8. The 2009 IRC defines Class I vapor retarders as a material or assembly with a rating of ≤ 0.1 perm, as defined using the desiccant method with Procedure A of ASTM E 96. The following materials are typically rated at ≤ 0.1 perm and therefore shall not be used on the interior side of air permeable insulation in above-grade exterior walls in warm-humid climates or below-grade exterior walls in any climate: rubber membranes, polyethylene film, glass, aluminum foil, sheet metal, foil-faced insulating sheathings, and foil-faced non-insulating sheathings. These materials can be used on the interior side of walls if air permeable insulation is not present (e.g., foil-faced rigid foam board adjacent to a below-grade concrete foundation wall is permitted).

   Note that this list is not comprehensive and other materials with a perm rating ≤ 0.1 also shall not be used. Also, if manufacturer specifications for a specific product indicate a perm rating above 0.1, then the material may be used, even if it is in this list. Also note that open-cell and closed-cell foam generally have perm ratings above this limit and may be used unless manufacturer specifications indicate a perm rating ≤ 0.1. Several exemptions to these requirements apply:
   - Class I vapor retarders, such as ceramic tile, may be used at shower and tub walls;
   - Class I vapor retarders, such as mirrors, may be used if mounted with clips or other spacers that allow air to circulate behind them.
9. Alternatively, either a drain tile that is pre-wrapped with a fabric filter or a Composite Foundation Drainage System (CFDS) that has been evaluated by ICC-ES per AC 243 are permitted to be used to meet this Item. Note that the CFDS must include a soil strip drain or another ICC-ES evaluated perimeter drainage system to be eligible for use. In an existing home (e.g, in a home undergoing a gut rehab.) a drain tile installed only on the interior side of the footings is permitted. Additionally, a drain tile is not required when a certified hydrologist, soil scientist, or engineer has determined that a crawlspace foundation, or an existing basement foundation (e.g., in a home undergoing a gut rehab.), is installed in Group I Soils (i.e. well-drained ground or sand-gravel mixture soils), as defined by 2009 IRC Table R405.1.
10. These Items not required for existing structural masonry walls (e.g., in a home undergoing a gut rehabilitation). Note this exemption does not extend to existing wall assemblies with masonry veneers.
11. Any of the following systems may be used: a monolithic weather-resistant barrier (i.e., house wrap) shingled at horizontal joints and sealed or taped at all joints; weather resistant sheathings (e.g., faced rigid insulation) fully taped at all "butt" joints; lapped shingle-style building paper or felts; or other water-resistive barrier recognized by ICC-ES or other accredited agency.
12. Apply pan flashing over the rough sill framing, inclusive of the corners of the sill framing; side flashing that extends over pan flashing; and top flashing that extends over side flashing or equivalent details for structural masonry walls.
13. Intersecting wall siding shall terminate 1 in. above the roof or higher, per manufacturer's recommendations. Continuous flashing shall be installed in place of step flashing for metal and rubber membrane roofs.
14. The assessment of whether the soil is expansive or collapsible shall be completed by a certified hydrologist, soil scientist, or engineer. As an alternative, a roof design is permitted to be used that deposits rainwater to a grade-level rock bed with a waterproof liner and a lateral drain pipe that meets discharge requirements per Item 3.2. As another alternative, a rainwater harvesting system is permitted to be used that drains overflow to meet discharge requirements per Item 3.2.
15. In addition to cement board, materials that have been evaluated by ICC-ES per AC 115 may also be used to meet this requirement. Monolithic tub and shower enclosures (e.g., fiberglass with no seams) are exempt from this backing material requirement unless required by the manufacturer. Paper-faced backerboard may only be used behind monolithic enclosures or waterproof membranes that have been evaluated by ICC-ES per AC 115, and then only if it meets ASTM mold-resistant standards ASTM D3273 or ASTM D6329.
16. If mold is present, effort should be made to remove all visible signs of mold (e.g., by damp wipe with water and detergent). If removal methods are not effective, then the material shall be replaced. However, stains that remain after damp wipe are acceptable. Lumber with "sap stain fungi" is exempt from this Item as long as the lumber is structurally intact.
17. For wet-applied insulation, follow manufacturer's drying recommendations. EPA recommends that lumber moisture content be ≤ 18%.

SECTION 02 30 10

SUBSURFACE CONDITIONS

PART 1 GENERAL

1.01 DESCRIPTION

A. General: Soils borings have been taken from the subject site and a report generated which is included as part of the project manual.

B. Use of Data:
   1. Bidders should visit the site and acquaint themselves with all existing conditions. Prior to bidding, bidders may make their own subsurface investigations to satisfy themselves as to site and subsurface conditions, but all such investigations shall be performed only under time schedules and arrangements approved in advance by the General Contractor.
   2. To that extent necessary all of the recommendations by the Soil Engineer have been incorporated as part of this Project Manual or the Construction Drawings.
   3. If conditions are encountered in the field during construction which vary from the facts of this report, the Soils Engineer should be contacted immediately to examine such changed conditions in the field and make the appropriate recommendations in light of the contract documents.
   4. The earthwork recommendations of the soils report presume that the earthwork will be monitored continuously by an Engineering Technician under the direction of a Registered Professional Geotechnical Engineer. The Contractor will contract these services directly with the Soils Engineer of record.
   5. A preconstruction meeting should be held at the site with the Owner, the Architect, the Structural Engineer, the General Contractor, the Excavating Contractor, the Soils Engineer and any other interested parties to review the scope and schedule of the proposed earthwork and foundation installation.

1.02 QUALITY ASSURANCE

A. Soil Engineer will be retained by the Contractor during the construction period to observe performance of work in connection with excavating, trenching, filling, backfilling, and grading.
   1. Soil Engineer will issue written reports for each site visit documenting his findings and all actions and/or recommendations made to the contractor during the site visit.
   2. Distribute reports to the Architect and Owner.

B. Adjustment of work: Readjust all work performed that does not meet technical or design requirements but make no deviations from the Contract Documents without specific and written approval from the Architect.

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION (NOT APPLICABLE)

END OF SECTION

SECTION 02 32 00

GEOTECHNICAL INVESTIGATIONS

PART 1 GENERAL

1.01 SOIL BORINGS

A. Test borings have been made at the site of the improvements. Logs of the test borings are included in a report titled, "Subsurface Exploration and Geotechnical Engineering, Scarborough Senior Living." The investigation and report were prepared by Geotechnical Consultants, Inc., Westerville, OH.

1. A copy of the report is included in this Project Manual following this section.

B. Logs of the test borings are not warranted by the Owner or the Architect, except that they reflect the best and only information available at the time of design.

END OF SECTION

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GEOTECHNICAL
CONSULTANTS INC.

GCI PROJECT No. 23-G-28545

Subsurface Exploration and Geotechnical Engineering Report

Scarborough Senior Living
456 to 500 St. Clair Avenue
Columbus, Ohio

Prepared for:
National Church Residences of Scarborough, LLC

January 25, 2024

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January 25, 2024

Ms. Jennifer Stokes
National Church Residences of Scarborough, LLC
2245 North Bank Drive
Columbus, Ohio 43220

Reference: Scarborough Senior Living
456 to 500 St. Clair Avenue – Columbus, Ohio
GCI Project No. 23-G-28545

Dear Ms. Stokes:

Geotechnical Consultants, Inc. has performed a subsurface exploration and prepared this geotechnical engineering report for the above referenced project. Our borings generally encountered a surface cover of asphalt pavement. Existing fill was encountered in five of the borings and was variable in quality and consistency. Typically, the underlying natural soils consisted of lean clay and glacial till. We noted the brown glacial till, however, had frequent water-bearing silt and sand layers. Groundwater was encountered in seven of the borings at depths of 9 to 18 feet. We did not encounter bedrock within the 35-foot maximum drilled depths of our borings.

In our opinion, the existing fills, underlying stained/soft soils, and prior development will pose challenges to the proposed site development. The primary geotechnical issues will be removing the existing construction, handling of existing fills, subgrade stability, and subgrade preparation. Foundation and slab support will depend on the chosen option. We discuss these and other geotechnical considerations in the report.

After you have reviewed the report, feel free to contact us with any questions you may have. We appreciate the opportunity to provide our services for this project and hope to continue our services through construction.

Respectfully submitted,
eotechnical Consultants, Inc.

Ryan D. Folsom, P.E.
Manager of Engineering Services

Curtis L. Miller, P.E.
In-House Reviewer

Distribution: Ms. Jennifer Stokes at NCR – pdf via email
Mr. Matthew D. Rule at NCR – pdf via email
Ms. Susan Earp Gregory at Moody Nolan – pdf via email
GCI File

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APPENDIX FOLLOWING PAGE NUMBER 18

General Notes for Soil Sampling and Classifications
Site Location Map and Boring Location Plan
Summary of Encountered Subsurface Conditions
Test Boring Logs (B-1 to B-10)

INTRODUCTION

As requested by Ms. Jennifer Stokes and authorized by Mr. Matthew Rule of National Church Residences of Scarborough, LLC, Geotechnical Consultants, Inc. (GCI) performed a subsurface exploration and prepared this geotechnical engineering report for the proposed development at 456 to 500 St. Clair Avenue in Columbus, Ohio. The client provided GCI with a set of schematic plans showing the proposed development layout (prepared by The Kleingers Group dated 12-4-2023).

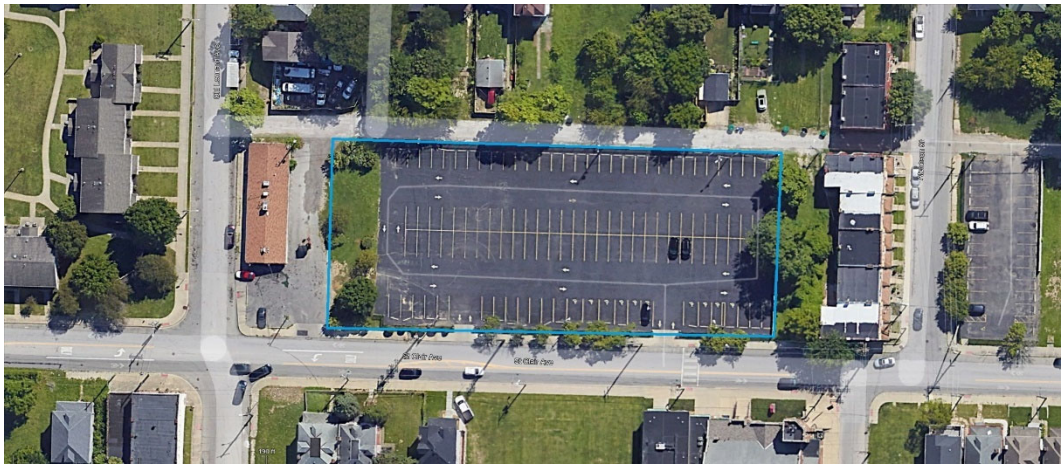
Our study consisted of ten (10) standard penetration borings performed at the site in open and accessible areas. GCI field located the borings in reference to site features and landmarks and using hand-held GPS devices. Locations should be considered approximate. We attach the test boring logs, a summary table of the encountered subsurface conditions, and a plan showing the approximate boring locations in the appendix.

The intent of this study was to evaluate subsurface conditions and offer geotechnical recommendations relative to site preparation, earthwork, foundations, slabs, and pavements for the proposed development. We issue this report prior to the receipt of final site development and grading plans. GCI should review these plans when available, and provide additional borings and recommendations, if necessary.

This report has been prepared for the exclusive use of National Church Residences of Scarborough, LLC and their consultants for specific application to the proposed project in Columbus, Ohio in accordance with generally accepted soil and foundation engineering practices. No warranty, expressed or implied, is made.

SITE LOCATION AND PROJECT DESCRIPTIONS

The project site is located along the east side of St. Clair Avenue between Atcheson Street and Old Leonard Avenue. The proposed development area lies within an existing asphalt parking lot. The below aerial photograph shows conditions at the site generally similar to those encountered during our drilling operations.



Aerial Photograph of Site (Google Earth); North to Page Left

Based on the provided RFP, we understand the structure will be four-stories, wood-framed, slab-on-grade with elevator(s). Column loads will be on the order of 75 kips and wall loads will be about 3 to 7 kips per lineal foot. In general, the building will be located along the west edge of the site and asphalt parking will be to the rear (east).

Topographically, the site is relatively flat and level and the existing parking lot elevation closely matched the proposed finished floor. As such, we expect that cuts and fills will be less than 2 feet to create the building pad and parking area.

SUBSURFACE CONDITIONS

GCI mobilized truck-mounted rotary drilling rigs (with automatic sampling hammers) to the site on January 10 and 11, 2024. We drilled ten standard penetration borings (B-1 to B-10) across the property and generally near the requested locations. The building area borings (B-1 to B-8) were drilled to a depth of 35 feet and the pavement area borings (B-9 and B-10) were drilled to a depth of 10 feet. We note that the numbering of the borings was changed from the requested; please refer to the attached boring location.

We have attached boring logs and the boring location plan to the appendix of this report. We summarize our subsurface findings in the attached table and in the discussion below. Refer to individual boring logs for more detailed subsurface information at specific boring locations.

Surface Cover and Fill

Eight of the borings encountered asphalt pavement at the ground surface. The thickness of the asphalt and stone ranged from 2 to 5 inches of asphalt over 4 to 9 inches of stone.

Below the pavement in three of the borings, and at the ground surface in borings B-1 and B-2, we encountered existing fill. The fill was comprised of various mixtures of stained lean clay (CL), brick and glass fragments, and some layers of stone or silty sand with gravel (SM). Standard penetration testing in the fill indicated generally medium stiff to stiff consistencies.

Natural Soils

At depths of about 1 to 6.5 feet, we encountered natural brown mottled gray lean clay (CL under the ASTM/Unified Soil Classification System). The upper layers (typically below asphalt pavement or fill) were locally stained a darker gray/black color. The clay was noted as moderately plastic with some zones having a higher plasticity. Standard penetration testing and hand penetrometer readings indicated variably soft to stiff consistencies.

At depths of 4 to 8 feet, we encountered brown glacial till. The glacial till was classified as commonly sandy lean clay to sandy lean clay with gravel (CL) and was noted as low to moderate plasticity. The till graded to a gray color in the deeper building area borings at depths of 10 to 12 feet. Standard penetration testing indicated the glacial till was generally medium stiff to very stiff in cohesive consistency. Some hard zones were encountered with depth.

We noted that the brown glacial till contained frequent sand and silt lenses, which commonly also had groundwater seepage. The practical ramifications of this are discussed later in the report.

Borings B-1 to B-8 terminated in the gray glacial till and borings B-9 and B-10 terminated in the brown glacial till at a depth of 10 feet.

Bedrock

We did not encounter bedrock within the maximum depth of the borings (35 feet).

Groundwater

We encountered groundwater seepage in seven of the borings at depths of 7 to 18 feet, but more commonly between 7 and 11 feet. Upon completion of drilling, the groundwater was measured at depths of 4 to 21 feet and had dissipated in boring B-8. The groundwater was typically encountered in the sand and silt layers of the glacial till.

Soil moisture conditions were noted a variably moist and very moist. Isolated wet samples were noted in proximity to the groundwater seepage. Note that soil moisture conditions and groundwater levels fluctuate in response to precipitation events, seasonal climate changes, stabilization time, and other factors that may differ from the time the measurements were made.

ANALYSES AND CONCLUSIONS

GEOTECHNICAL EVALUATION - BUILDING FOUNDATIONS

Our borings revealed a variable depth of existing fill across the site. The depth of the fill was relatively shallow but did extend to a depth of 6.5 feet in boring B-2. We expect the fill is a result of prior development at the site. A review of historic aerial photographs suggest the site contained several residential structures fronting St. Clair Avenue. These were demolished in phases until the site was paved.

Most of the structures were demolished prior to 1980s and we suspect that the majority of the fill was placed to reach the grade of the existing parking lot and backfill areas of demolished houses. We noted the fill as typical to urban areas, containing stained clay and trace brick, glass, and other construction debris. We note, however, our borings may

not have been drilled within the prior structure footprints and the potential for other areas of deeper fill may exist.

The existing fills in their current state, pose a risk to foundations in terms of total and differential settlement. We provide the following options to mitigate this risk and summarize some of the potential challenges with each option.

Option 1: Fill Removal and Replacement

The first option is to remove the existing fill, buried former structural elements (if and where encountered), and soft or heavily stained natural soils from within the building footprint plus 10 feet laterally beyond (where possible). The excavation would then be backfilled with structural fill (as we describe in the *Site Preparation and Earthwork* section of report). Prior to new fill placement, the undercut subgrade should be carefully proof-rolled to assess the stability of the natural soils. Soft subgrades should be brought to a stable condition prior to new fill placement.

In our opinion, existing non-organic fill and the natural, non-organic site soils can be re-used as structural fill. Fill with excessive amounts of organic material and other deleterious material is not suitable for reuse in controlled fill; these materials can be disposed of at an off-site location, wasted to green spaces, or reused in landscaping mounds.

Once this procedure is completed, foundations could be placed in the new, controlled fill or natural soils at design grades with no unusual undercuts anticipated, and the floor slab would be constructed on the engineered fill. This

option would mitigate the risk of foundation and slab settlement associated with the existing fill. We note that it will be difficult to implement this approach during long periods of wet or cold weather conditions.

Option 2: Extend Foundations

The second option for building construction is to leave the existing, non-organic fill in-place for slab support, and to extend the foundations downward (through the new and existing fill and any local soft or heavily stained zones in the natural soils) to bear directly on stable, natural soils. Undercuts can be backfilled to grade with a controlled density fill (CDF) such as K-krete or lean concrete to allow footings to be constructed at design grade. Depth of undercuts will depend on final site grades and encountered conditions.

With this procedure, there is some risk of slab settlement due to the existing fill that would remain in-place. In our opinion, this risk is low, provided the subgrade is brought to a firm and stable condition, as judged by a proof-roll. The owner must assume the risk of possible settlement and slab cracking when constructing over the existing fill materials. At a minimum, a partial remove and replace (to a minimum depth of 24 inches) along with several passes with a large vibratory roller should be budgeted to help create a firm and stable subgrade for construction and to further mitigate the potential for differential settlement in the slabs.

Option 3: Ground Improvement (Rammed Aggregate Piers or GeoPiers®)

A third option of modifying the existing fill/natural soils with aggregate piers is also feasible. This option would eliminate the need for foundation undercuts or extensive earthwork operations to remediate the existing fill and stained/soft soils.

Geopiers® are installed under a design-build contract by a specialty contractor. This technique involves drilling auger holes through the unsuitable soils and ramming aggregate into the holes in 12 to 24-inch lifts up to the bearing elevation. Ramming both densifies the aggregate and forces the aggregate laterally into the sidewalls of the holes, resulting in improved bearing and settlement characteristics of the soils to support footings.

Once the piers are completed, shallow spread footings with slab-on-grade are used. Post construction settlements of 1-inch total settlement and ½ inch or less differential movement should be feasible for foundation supported by geopier-improved ground (this is to be confirmed by Geopier® or the designer). In our opinion, allowable bearing pressures in excess of 4,000 psf should be feasible with properly designed and installed piers. These higher bearing capacities will reduce footing sizes and help control total and differential settlement.

Geopiers are designed by Geopier® and are installed by a specialty contractor. The process requires a final foundation plan and close coordination between Geopier® and the site work contractor. Temporary casing may be needed to install piers where groundwater seepage is encountered, where cave-ins from granular fill or natural soils occur, or other circumstances warrant use of casing. We note that rubble, large concentrations of brick, or other debris (slabs,

foundations, old utilities, etc.) may interfere with pier installation and these challenges should be discussed prior to construction. Ultimately, some modification of design or relocating piers may be needed depending on encountered site conditions.

Bearing Capacity

All footings should bear on stable natural soils or new, controlled fills placed directly over stable, natural soils. If a rammed aggregate pier solution is selected, the foundation excavations will have special provisions that need to be met to allow for proper bearing conditions on the piers. For the first two options outlined above, foundations bearing on acceptable soils can be designed for an allowable bearing capacity of **3,000 pounds per square foot (psf)**. We recommend placement of longitudinal reinforcing steel in the bottoms of continuous footings.

Regardless of calculated sizes, we recommend minimum sizes of 16 inches wide for wall footings and 30 inches square for column pads to prevent a “punch” effect. All exterior footings should extend to local frost bearing depth (32 inches) or to stable bearing (as stated above), whichever is deeper. Interior footings in heated areas may be placed as shallow as feasible, if bearing on acceptable soils. If foundations will be exposed to winter weather and freezing temperatures, interior footings should be extended to the local frost depth.

SITE PREPARATION

Existing and Previous Development

GCI recommends all utilities be removed and rerouted from below the proposed building footprint areas plus 10 feet laterally. Abandoned utility lines (outside the zone of

influence) should be capped to prevent loss of soil. Remove existing asphalt below the proposed building area. When preparing the site, remove old foundations, below-grade structures, and obstacles that interfere with new construction. Properly backfill resultant excavations with structural fill to proposed grade (as described below in the discussion of new fill placement). As noted previously, a partial remove and replace of the existing fill could be useful in identifying areas of rubble or prior construction that could interfere with pier installation or foundation undercuts.

Topsoil, vegetation, roots, stumps from removed trees, and other organic materials should be completely removed to expose stable soils prior to placing new fill, underslab aggregate, or pavement base aggregate. Stripping should extend to a minimum of 5 feet laterally beyond proposed buildings and pavement areas. Topsoil and organic matter can be stockpiled for reuse in landscaping mounds, redistributed in proposed green spaces areas, or disposed at an off-site location.

Excavations

Bedrock was not located within 35 feet of the surface, and, as such, rock excavation is not an issue for the project. The natural site soils and fill can be excavated with conventional track hoe equipment. Care should be taken not to undermine existing sidewalks, roadways and adjacent properties during the project excavations. As noted before, the granular fill and granular natural soils will require some additional laybacks or shoring to maintain stable excavations. Temporary excavation support in the form of a temporary earth retention system may be needed to complete the project. **All site excavations should comply with current OSHA regulations.**

Impact of Groundwater on Construction

We encountered groundwater seepage in seven of the borings at depths of 7 to 18 feet. Upon completion of drilling, the groundwater was measured at depths of 4 to 21 feet. Based on this information, we do not expect that groundwater will be a significant issue during construction with the exception of the elevator excavations or deep utilities. Water seepage from the frequent sand and silt lenses of the glacial till should be expected. Seepage may also occur from granular zones in the existing fill (where left in-place).

Site excavations will need to be dewatered to allow construction to proceed in dry conditions. This could include working mats of crush stone and local sumps with construction pumps. We do not anticipate the need for a sophisticated dewatering system for the project unless excavations below the encountered groundwater levels are planned. Contact GCI if excavations below about 8 feet from the existing ground surface are planned.

Subgrade Preparation and Stabilization

The project will include slab-on-grade construction and new pavements. Once the stripping is completed, the exposed subgrades (stone base, existing fill, or natural lean clay including glacial till) should be thoroughly proof-rolled using a fully-loaded, tandem-axle dump truck (or equivalent) to identify potential soft, yielding subgrade areas. Soft or unstable areas identified during the proof-roll should be undercut to firm, stable conditions or otherwise stabilized prior to placing new fill or underslab aggregate. Unstable areas encountered during proof-rolling should be stabilized or removed and replaced with structural fill.

Stabilization of soft subgrades by disking, aerating/drying, and re-compaction may be feasible during traditionally drier times of the year. During wet seasons, partial undercutting and replacing of wet soils with structural fill, drying with soil additives such as lime, or use of geosynthetics may be needed to create a stable subgrade before placing controlled fills. The use of soil additives, such as lime and flyash, or installation of geosynthetics should be reviewed by GCI prior to use in the field. Fewer problems with soft subgrades are expected if work is performed during traditionally drier times of the year (i.e., late spring, summer, and early fall). Traditionally wetter seasons (i.e., late fall, winter, and early spring) will contribute to more problems associated with soft, very moist subgrades.

New Fill Placement

Based on the proposed finish grades, we anticipate only minor regrading (estimated at generally less than 2 feet of cuts and fills) will be needed; unless the option to remove and replace the existing fill is selected. We provide the following general guidelines.

With stable subgrades, structural fill can be placed. In our opinion, excavated non-organic fill and natural site soils can be reused as structural fill with proper moisture control. Milled asphalt should not be used as structural fill below building areas, but in our opinion, it can be used for base course below pavements. Off-site borrow materials should be reviewed by our office prior to use.

Place controlled fills in maximum 8-inch thick loose lifts and compact to a minimum of 98% of the maximum Standard Proctor dry density (ASTM D-698). The moisture in the site soils should be controlled to within ±3% of the optimum Standard Proctor moisture content. Depending on the time of year of earthwork, moisture adjustment of the site

soils may be required to achieve proper compaction. Cohesive soils will compact best with a sheepsfoot roller, while granular soils will compact best with a vibratory smooth-drum roller.

SLABS

Provided the site is prepared as discussed, conventional slab-on-grade is feasible for the building. As discussed previously, a partial removal and replacement of the existing fill should be included in the budget. GCI recommends a minimum of 4 inches of underslab gravel beneath lightly loaded slab-on-grade floors to provide uniform support for the slab and a capillary cut-off for moisture. We recommend thicker and well-draining aggregate be used in the elevator pit as discussed below. We recommend placing a vapor barrier directly below the slab in areas where moisture may be a problem with slab-on-grade floor coverings.

BELOW-GRADE WALLS / ELEVATOR PITS

The multi-story building will include elevators with pits below the slab(s). Retaining walls allowed to move freely at the top of the wall should be designed using active lateral earth pressure. Walls restrained at both top and bottom (conventional elevator pit walls) should be designed to resist an at-rest lateral soil pressure. The design loading depends on the type of backfill material used and boundary support conditions. The recommended equivalent fluid pressures for two types of soils and loading conditions (without surcharge loads) are shown on the following table:

Soil Type	Equivalent Active Fluid Pressure (pcf)	Equivalent At-Rest Fluid Pressure (pcf)
Lean Clay (site soils)	55	70
Sand and Gravel (properly compacted)	35	55

Cohesive soils are not recommended as wall backfill due to their poor drainage characteristics and potential for lateral wall loads resulting from surface frost. We recommend that granular material (less than 15% passing the No. 200 sieve) be used for all wall backfill. The stone should be placed in a wedge defined by a line extend upward from the footing at a 35° angle from the vertical to allow use of the lower values above.

As noted above, use granular backfill around the elevator pit walls, and install perimeter drains tied into permanent sumps. Alternatively, design the pits for full hydrostatic pressure. We recommend damp-proofing below grade walls.

SEISMIC FACTOR

GCI evaluated the Seismic Site Classification using guidelines set forth in the Ohio Building Code (OBC) section 1613.5.5 “Site classification for seismic design”. Based on the encountered soil conditions, we estimate the site has a Site Class D – “stiff soil profile”.

PAVEMENTS

Provided the site is properly prepared, conventional aggregate base and flexible asphalt wearing course pavements can be used. Prior to pavement construction, the subgrade should be carefully proof-rolled, and stabilized as necessary to provide a CBR value of at least 3. A specific pavement design is beyond the scope of work of this report; GCI can provide one if requested. A site-specific pavement design would require additional laboratory testing and pavement use criteria.

New Pavement Areas

We assume that traffic will consist of automobiles and occasional trucks. Based on our experience with similar projects and soils, and assuming properly prepared subgrades, we recommend a minimum light-duty pavement section consisting of 3 inches of asphalt over 8 inches of aggregate base. For heavy-duty traffic areas, including the main traffic aisles and areas subjected to occasional refuse truck traffic, and occasional truck deliveries, we suggest a pavement section consisting of a minimum of 4 inches of asphalt over 10 inches of aggregate base. We recommend a minimum of 8 inches of air-entrained, Portland cement concrete for the dumpster pad and the dumpster pad approach area.

Providing adequate subbase drainage is important to future pavement performance. Finger drains connecting to weep-holes in inlets, proper grading of pavement subgrades and surfaces to shed run-off, and underdrains in pavement swales are suggested subbase drainage methods and should be designed by the site civil engineer. Installing a medium-duty geogrid below the base aggregate course in areas subjected to stopping and turning traffic or concentrated traffic flow, such as the main entrance/exit drives, will increase the structural number of the pavement section and improve the pavement performance.

SITE PREPARATION AND EARTHWORK

We provide below general guidelines for site preparation and earthwork operations.

1. Remove any existing construction (old foundations and slabs, pavements, subsurface utilities, etc.) from within the construction limits plus 10 feet laterally. Properly backfill resulting excavations, as needed, with compacted structural fill. Existing subsurface utilities located outside of the proposed building footprint can be abandoned in place, provided the demolition contractor caps the ends of the abandoned lines to prevent loss of soil.

2. Remove topsoil and vegetation from the site plus 5 feet laterally.

3. If a remove and replace option is chosen, remove existing fill and buried structural elements from former construction from below the proposed building footprint, plus 10 feet laterally beyond.

4. Thoroughly and carefully proof-roll exposed subgrades to identify potential soft/unstable areas. Undercut soft spots identified in the proof-roll or otherwise stabilize soft spots prior to placing controlled fill or underslab aggregate. Budget for a partial remove and replacement of the existing fill to a depth of 24 inches where left in-place.

5. Place controlled fills to design grade within the proposed building pads and pavement areas, as required. Non-organic site soils are suitable for reuse in controlled fills. Borrow materials should be reviewed by our office prior to use.

6. Place controlled fills in maximum 8-inch thick loose lifts and compact to a minimum of 98% of the maximum Standard Proctor dry density (ASTM D-698). The moisture in the site soils should be controlled to within ±3% of the optimum Standard Proctor moisture content. Depending on the time of year of earthwork, moisture adjustment of the site soils may be required to achieve proper compaction.

   Cohesive soils will compact best with a static-weight sheepsfoot roller and granular materials will compact best with a vibratory smooth drum roller. Clay-based soils that are at or slightly over the optimum moisture content will tend to pump if exposed to vibratory sheepsfoot compaction equipment.

7. Construct foundations and start building construction after the building pads are filled to design grade, as required. Refer to the *Geotechnical Evaluation* and *Foundations* sections of this report for specific foundation design parameters.

8. The building pad and new pavement areas should be steel-wheel rolled to a smooth surface prior to placement of underslab or base course aggregate. Subgrade preparation during wet seasons may require the use of engineering fabric or geogrid.

9. It is recommended that GCI be retained to observe proof-rolling operations, cut and fill operations, and footing excavations.

10. If work is performed during the winter (e.g., when freezing temperatures occur), special protective measures will be required during filling and foundation construction procedures. Contact GCI for additional recommendations on cold-weather earthwork operations, if applicable.

CONSTRUCTION MATERIALS ENGINEERING AND TESTING

GCI provides construction materials engineering and testing services. For project continuity throughout construction, we recommend that GCI be retained to observe, test, and document:

- earthwork procedures (stripping, fill placement, compaction, utility trench backfill, etc.),
- slab preparation (proof-rolling, excavations, undercuts, etc.),
- geopier installations,
- concrete placement and compressive strength testing (footings, slabs, pavements, etc.), and
- structural steel (welds, bolts, etc.).

The purpose of this work is to assess that the intent of our recommendations is being followed and to make timely changes to our recommendations (as needed) in the event site conditions vary from those encountered in our borings. Please contact our field department to initiate these services.

FINAL

The recommendations presented in this report are based on the borings that were drilled, and information provided. Note that if any changes in the nature, design or locations of the construction are planned, conclusions and recommendations should not be considered valid unless verified in writing by GCI. The recommendations contained in this report are the opinion of GCI based on the subsurface conditions found in the borings and available development information.

This report has been issued to the client for design purposes. It should be noted that the nature and extent of variations between borings might not become evident until construction. If variations then appear evident, it will be necessary to re-evaluate the recommendations of this report.

If you have any questions or need for any additional information, please contact our office. It has been a pleasure to be of service to you on this project, and we hope to continue our services through construction.

GEOTECHNICAL
CONSULTANTS INC.

APPENDIX – Scarborough Senior Living – Columbus, Ohio

General Notes for Soil Sampling and Classifications
Site Location Map and Boring Location Plan
Summary of Encountered Subsurface Conditions
Test Boring Logs (B-1 to B-10)

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GENERAL NOTES FOR SOIL SAMPLING AND CLASSIFICATIONS

BORINGS, SAMPLING AND GROUNDWATER OBSERVATIONS:

Drilling and sampling were conducted in accordance with procedures generally recognized and accepted as standard methods of exploration of subsurface conditions. The borings were drilled using a truck-mounted drill rig using auger boring methods with standard penetration testing performed in each boring at intervals ranging from 1.5 to 5.0 feet. The stratification lines on the logs represent the approximate boundary between soil types at that specific location and the transition may be gradual.

Water levels were measured at drill locations under conditions stated on the logs. This data has been reviewed and interpretations made in the text of the report. Fluctuations in the level of the groundwater may occur due to other factors than those present at the time the measurements were made.

The Standard Penetration Test (ASTM-D-1586) is performed by driving a 2.0 inch O.D. split barrel sampler a distance of 18 inches utilizing a 140 pound hammer free falling 30 inches. The number of blows required to drive the sampler each 6 inches of penetration are recorded. The summation of the blows required to drive the sampler for the final 12 inches of penetration is termed the Standard Penetration Resistance (N). Soil density/consistency in terms of the N-value is as follows:

COHESIONLESS DENSITY		COHESIVE CONSISTENCY	
0-10	Loose	0-4	Soft
10-30	Medium Dense	4-8	Medium Stiff
30-50	Dense	8-15	Stiff
50 +	Very Dense	15-30	Very Stiff
		30 +	Hard

SOIL MOISTURE TERMS

Soil Samples obtained during the drilling process are visually characterized for moisture content as follows:

MOISTURE CONTENT	DESCRIPTION
Damp	Soil moisture is much drier than the Atterberg plastic limit (where soils are cohesive) and generally more than 3% below Standard Proctor “optimum” moisture conditions. Soils of this moisture generally require added moisture to achieve proper compaction.
Moist	Soil moisture is near the Atterberg plastic limit (cohesive soils) and generally within ±3% of the Standard Proctor “optimum” moisture content. Little to no moisture conditioning is anticipated to be required to achieve proper compaction and stable subgrades.
Very Moist	Soil moisture conditions are above the Atterberg plastic limit (cohesive soils) and generally greater than 3% above Standard Proctor “optimum” moisture conditions. Drying of the soils to near “optimum” conditions is anticipated to achieve proper compaction and stable subgrades.
Wet	Soils are saturated. Significant drying of soils is anticipated to achieve proper compaction and stable subgrades.

SOIL CLASSIFICATION PROCEDURE:

Soil samples obtained during the drilling process are preserved in plastic bags and visually classified in the laboratory. Select soil samples may be subjected to laboratory testing to determine natural moisture content, gradation, Atterberg limits and unit weight. Soil classifications on logs may be adjusted based on results of laboratory testing.

Soils are classified in accordance with the ASTM version of the Unified Soil Classification System. ASTM D-2487 “Classification of Soils for Engineering Purposes (Unified Soil Classification System) describes a system for classifying soils based on laboratory testing. ASTM D-2488 “Description and Identification of Soil (Visual-Manual Procedure) describes a system for classifying soils based on visual examination and manual tests.

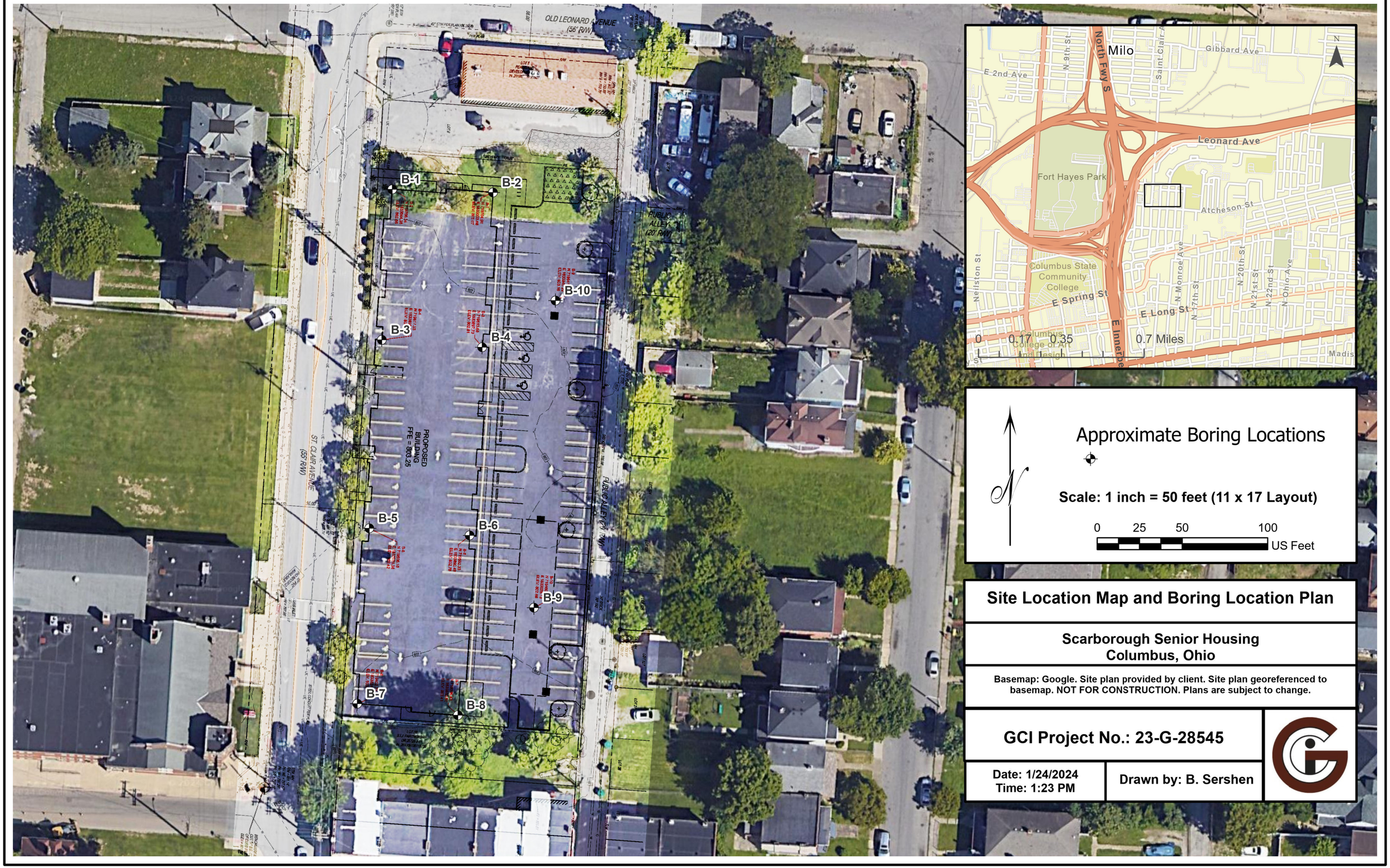
Soil classifications are based on the following tables (see reverse side):

GENERAL NOTES FOR SOIL SAMPLING AND CLASSIFICATIONS

PARTICLE SIZE DEFINITION		
Boulders:		>12"
Cobbles:		3" to 12"
Gravel:	Coarse:	3/4" to 3"
	Fine:	No. 4 (3/16") to 3/4"
Sand:	Coarse	No. 10 (2.0mm) to No. 4 (4.75mm)
	Medium	No. 40 (0.425mm) to No. 10 (2.0mm)
	Fine	No. 200 (0.074mm) to No. 40 (0.425mm)
Silt & Clay		<0.074mm; classification based on overall plasticity; in general clay particles <0.005mm.

CONSTITUENT MODIFIERS	
Trace	Less than 5%
Few	5-10%
Little	15-25%
Some	30-45%
Mostly	50-100%

ASTM/UNIFIED SOIL CLASSIFICATION AND SYMBOL CHART		
COARSE-GRAINED SOILS (more than 50% of materials is larger than No. 200 sieve size)		
GRAVELS More than 50% of coarse fraction larger than No. 4 sieve size	*Clean Gravel (less than 5% fines)*	
	GW	Well-graded gravel, gravel-sand mixtures, little or no fines
	GP	Poorly-graded gravels, gravel sand mixtures, little or no fines
	Gravels with fines (more than 12% fines)	
	GM	Silty gravels, gravel-sand-silt mixtures
	GC	Clayey gravels, gravel-sand-clay mixtures
SANDS More than 50% of coarse fraction smaller than No. 4 sieve size	*Clean Sands (Less than 5% fines)*	
	SW	Well-graded sands, gravelly sands, little or no fines
	SP	Poorly-graded sands, gravelly sands, little or no fines
	Sands with fines (More than 12% fines)	
	SM	Silty sands, sand-silt mixtures
	SC	Clayey sands, sand-clay mixtures
Depending on percentage of fines (fraction smaller than No. 200 sieve size), coarse-grained soils are classified as follows: Less than 5 percent ……GW, GP, SW, SP Greater than 12 percent ……GM, GC, SM, SC 5 to 12 percent ……Borderline cases requiring dual symbols: SP-SM, GP-GM, etc.		
FINE-GRAINED SOILS (50% or more of material is smaller than No. 200 sieve size)		
SILTS AND CLAYS Liquid Limit less than 50%	ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity
	CL	Inorganic clays or low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays
	CL-ML	Inorganic silty clay of slight plasticity, P.I. between 4 and 7
	OL	Organic silts and organic silty clays of low plasticity
SILTS AND CLAYS Liquid Limit 50% or greater	MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts
	CH	Inorganic clays of high plasticity, fat clays
	OH	Organic clays or medium to high plasticity, organic silts
HIGHLY ORGANIC SOILS	PT	Peat and other highly organic soils



Approximate Boring Locations

Scale: 1 inch = 50 feet (11 x 17 Layout)

0 25 50 100 US Feet

Site Location Map and Boring Location Plan

Scarborough Senior Housing
Columbus, Ohio

Basemap: Google. Site plan provided by client. Site plan georeferenced to basemap. NOT FOR CONSTRUCTION. Plans are subject to change.

GCI Project No.: 23-G-28545

Date: 1/24/2024
Time: 1:23 PM

Drawn by: B. Sershen

Summary of Encountered Subsurface Conditions

Scarborough Senior Living
St. Clair Avenue - Columbus, Ohio
GCI Job Number: 23-G-28545

Borehole	Surface Layer	Pavement Thickness (inches)		Bottom of Fill Cover (feet)	Groundwater: Level Encountered (ft)	Groundwater: Level at Completion (ft)	Depth to Top of Lean Clay (ft)	Depth to Top of Brown Till (ft)	Depth to Top of Gray Till (ft)	Bottom of Boring Depth (ft)
		Asphalt	Stone		Depth	Depth				
B-1	Fill	--	--	2.0	9	12.5	2.0	7.0	11.0	35.0
B-2	Topsoil	--	--	6.5	9	21	6.5	7.5	12.0	35.0
B-3	Asphalt	2.5	4	--	7	6	0.5	6.0	10.0	35.0
B-4	Asphalt	5	4	--	18	10	0.8	7.0	12.0	35.0
B-5	Asphalt	4	7	--	8	4	0.9	7.0	11.0	35.0
B-6	Asphalt	3	5	3.0	--	--	3.0	4.0	10.0	35.0
B-7	Asphalt	3	9	--	11	21	1.0	7.0	12.0	35.0
B-8	Asphalt	2	8	3.0	9	--	3.0	7.0	12.0	35.0
B-9	Asphalt	2	9	--	--	--	0.9	4.5	--	10.0
B-10	Asphalt	2	7.5	4.0	--	--	4.0	8.0	--	10.0

Boring Location
Asphalt Depths
Avg: 2.9 inches
Max: 5.0 inches
Min: 2.0 inches

Boring Location
Stone Base Depths
Avg: 6.7 inches
Max: 9.0 inches
Min: 4.0 inches

TEST BORING LOG

PROJECT NAME **Scarborough Senior Living - St. Clair Avenue - Columbus, Ohio** BORING NO. **B-1**

PROJ. SURF. ELEV.

CLIENT **National Church Residences of Scarborough, LLC** NO. **23-G-28545** DATE DRILLED **1/11/2024**

GROUND WATER OBSERVATION

12.5 FEET BELOW SURFACE AT COMPLETION

_____ FEET BELOW SURFACE AT 24 HOURS

_____ FEET BELOW SURFACE AT ____ HOURS

Proportions Used

Trace	Less than 5%
Few	5 to 10%
Little	15 to 25%
Some	30 to 45%
Mostly	50 to 100%

140 lb Wt. x 30" fall on 2" O.D. Sampler

Cohesionless Density

0 - 10	Loose
10 - 30	Medium Dense
30 - 50	Dense
50 +	Very Dense

Cohesive Consistency

0 - 4	Soft
4 - 8	Medium Stiff
8 - 15	Stiff
15 - 30	Very Stiff
30 +	Hard

LOCATION OF BORING **See Boring Location Plan**

DEPTH	Pocket Penetrometer (tsf)	Sample Depths From To	Type of Sample	Blows per 6" on Sampler From To 0-6	6-12	12-18	Moisture Density or Consist.	Strata Change Depth*	SOIL IDENTIFICATION Remarks include color, type of soil, etc. Rock-color, type, condition, hardness
	1.0	0.0-1.5	SS	4	5	5	Very Moist	2.0	FILL: Dark Stained/Black Lean Clay (CL) - trace glass and brick
	2.0	2.0-3.5	SS	3	5	7	Moist to Very Moist		Stained to Brown Mottled Gray Lean Clay (CL) - moderate to high plasticity, few sand, few gravel
5	3.0	4.0-5.5	SS	3	4	4	Moist	7.0	
	3.0	8.5-10.0	SS	3	6	6	Very Moist		Brown Sandy Lean Clay (CL); glacial till - low to moderate plasticity, little to some sand, few gravel; frequent saturated sand and silt layers **Water Seepage at 9 feet**
10								11.0	
	3.5	13.5-15.0	SS	5	6	8	Moist to Very Moist		Gray Sandy Lean Clay with Gravel (CL); glacial till - low to moderate plasticity, little sand, little gravel
15									
	3.0	18.5-20.0	SS	6	7	7	Moist		Layer of Lean Clay with Sand (CL) - low to moderate plasticity, little sand, trace gravel
20									
	2.0	23.5-25.0	SS	6	6	8	Moist to Very Moist		
25									
	3.0	28.5-30.0	SS	5	7	7	Moist		
30									
	3.0	33.5-35.0	SS	6	7	8	Moist		
								35.0	BOTTOM OF BORING: 35 feet

*** The stratification lines represent the approximate boundary between soil types and the transition may be gradual.**

720 Green Crest Drive • Westerville, Ohio 43081 • 614-895-1400

TEST BORING LOG

PROJECT NAME **Scarborough Senior Living - St. Clair Avenue - Columbus, Ohio** BORING NO. **B-2**

PROJ. SURF. ELEV.

CLIENT **National Church Residences of Scarborough, LLC** NO. **23-G-28545** DATE DRILLED **1/10/2024**

GROUND WATER OBSERVATION

21.0 FEET BELOW SURFACE AT COMPLETION

_____ FEET BELOW SURFACE AT 24 HOURS

_____ FEET BELOW SURFACE AT _____ HOURS

Proportions Used

Trace	Less than 5%
Few	5 to 10%
Little	15 to 25%
Some	30 to 45%
Mostly	50 to 100%

140 lb Wt. x 30" fall on 2" O.D. Sampler

Cohesionless Density

0 - 10	Loose
10 - 30	Medium Dense
30 - 50	Dense
50 +	Very Dense

Cohesive Consistency

0 - 4	Soft
4 - 8	Medium Stiff
8 - 15	Stiff
15 - 30	Very Stiff
30 +	Hard

LOCATION OF BORING **See Boring Location Plan**

DEPTH	Pocket Penetrometer (tsf)	Sample Depths From To	Type of Sample	Blows per 6" on Sampler From To 0-6	6-12	12-18	Moisture Density or Consist.	Strata Change Depth*	SOIL IDENTIFICATION Remarks include color, type of soil, etc. Rock-color, type, condition, hardness
	--	0.0-1.5	SS	3	13	14	Moist to Very Moist	0.5	FILL: Topsoil
									FILL: Silty Sand with Gravel (SM) and Stone
	--	2.0-3.5	SS	9	6	7	Moist		
	--	4.0-5.5	SS	3	3	5	Moist		
5								6.5	
								7.5	Brown Mottled Gray Lean Clay (CL) - moderate plasticity, few sand
	3.5	8.5-10.0	SS	3	3	4	Very Moist to Moist		Brown Sandy Lean Clay (CL); glacial till - low to moderate plasticity, little to some sand, few gravel; frequent saturated sand and silt layers
10									**Water Seepage at 9 feet**
								12.0	
	2.0	13.5-15.0	SS	5	7	5	Very Moist		Gray Sandy Lean Clay with Gravel (CL); glacial till - low to moderate plasticity, little sand, little gravel
15									
	2.0	18.5-20.0	SS	7	8	8	Very Moist		Layer of Lean Clay with Sand (CL) - low to moderate plasticity, little sand, trace gravel
20									
	2.5	23.5-25.0	SS	4	4	5	Moist		
25									
	2.0	28.5-30.0	SS	5	5	6	Moist		Layer of Lean Clay with Sand (CL) - low to moderate plasticity, little sand, trace gravel
30									
	4.5+	33.5-35.0	SS	5	7	8	Moist		
								35.0	BOTTOM OF BORING: 35 feet

*** The stratification lines represent the approximate boundary between soil types and the transition may be gradual.**

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TEST BORING LOG

PROJECT NAME **Scarborough Senior Living - St. Clair Avenue - Columbus, Ohio** BORING NO. **B-3**

PROJ. SURF. ELEV.

CLIENT **National Church Residences of Scarborough, LLC** NO. **23-G-28545** DATE DRILLED **1/11/2024**

GROUND WATER OBSERVATION

6.0 FEET BELOW SURFACE AT COMPLETION

_____ FEET BELOW SURFACE AT 24 HOURS

_____ FEET BELOW SURFACE AT _____ HOURS

Proportions Used

Trace	Less than 5%
Few	5 to 10%
Little	15 to 25%
Some	30 to 45%
Mostly	50 to 100%

140 lb Wt. x 30" fall on 2" O.D. Sampler

Cohesionless Density

0 - 10	Loose
10 - 30	Medium Dense
30 - 50	Dense
50 +	Very Dense

Cohesive Consistency

0 - 4	Soft
4 - 8	Medium Stiff
8 - 15	Stiff
15 - 30	Very Stiff
30 +	Hard

LOCATION OF BORING **See Boring Location Plan**

DEPTH	Pocket Penetrometer (tsf)	Sample Depths From To	Type of Sample	Blows per 6" on Sampler 0-6	6-12	12-18	Moisture Density or Consist.	Strata Change Depth*	SOIL IDENTIFICATION Remarks include color, type of soil, etc. Rock-color, type, condition, hardness
								0.2	2.5" of Asphalt over 4" of Stone
	1.5	1.0-3.0	SS	2 4	3	3	Moist	0.5	Stained to Brown Mottled Gray Lean Clay (CL) - moderate to high plasticity, few sand, few gravel
	2.5	3.0-5.5	SS	2 3	3	3	Moist		
5								6.0	
	2.0	8.5-10.0	SS	5	6	6	Very Moist		Brown Sandy Lean Clay (CL); glacial till - low to moderate plasticity, little to some sand, few gravel; frequent saturated sand and silt layers **Water Seepage at 7 feet**
10								10.0	Gray Sandy Lean Clay with Gravel (CL); glacial till - low to moderate plasticity, little sand, little gravel
	2.5	13.5-15.0	SS	5	6	9	Moist		
15									
	3.0	18.5-20.0	SS	5	5	5	Moist to Very Moist		
20									
	4.0	23.5-25.0	SS	6	7	10	Moist		
25									
	4.5+	28.5-30.0	SS	20	20	20	Moist		
30									
	4.5+	33.5-35.0	SS	31	40	43	Moist		
								35.0	BOTTOM OF BORING: 35 feet

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TEST BORING LOG

PROJECT NAME **Scarborough Senior Living - St. Clair Avenue - Columbus, Ohio** BORING NO. **B-4**

PROJ. SURF. ELEV.

CLIENT **National Church Residences of Scarborough, LLC** NO. **23-G-28545** DATE DRILLED **1/11/2024**

GROUND WATER OBSERVATION

10.0 FEET BELOW SURFACE AT COMPLETION

_____ FEET BELOW SURFACE AT 24 HOURS

_____ FEET BELOW SURFACE AT ____ HOURS

Proportions Used

Trace	Less than 5%
Few	5 to 10%
Little	15 to 25%
Some	30 to 45%
Mostly	50 to 100%

140 lb Wt. x 30" fall on 2" O.D. Sampler

Cohesionless Density

0 - 10	Loose
10 - 30	Medium Dense
30 - 50	Dense
50 +	Very Dense

Cohesive Consistency

0 - 4	Soft
4 - 8	Medium Stiff
8 - 15	Stiff
15 - 30	Very Stiff
30 +	Hard

LOCATION OF BORING **See Boring Location Plan**

DEPTH	Pocket Penetrometer (tsf)	Sample Depths From To	Type of Sample	Blows per 6" on Sampler From To 0-6	6-12	12-18	Moisture Density or Consist.	Strata Change Depth*	SOIL IDENTIFICATION Remarks include color, type of soil, etc. Rock-color, type, condition, hardness
								0.4	5" of Asphalt over 4" of Stone
	1.0	1.0-3.0	SS	3 5	4	4	Moist	0.8	Stained to Brown Mottled Gray Lean Clay (CL) - moderate to high plasticity, few sand, few gravel; staining extended to about 4 feet
	1.0	3.0-5.5	SS	2 4	3	3	Moist		
5								7.0	
	2.0	8.5-10.0	SS	2	2	4	Very Moist		Brown Sandy Lean Clay (CL); glacial till - low to moderate plasticity, little to some sand, few gravel; frequent saturated sand and silt layers
10								12.0	
	2.0	13.5-15.0	SS	5	5	7	Very Moist		Gray Sandy Lean Clay to Sandy Lean Clay with Gravel (CL); glacial till - moderate plasticity, little to some sand, few to little gravel
15									
	2.0	18.5-20.0	SS	2	3	4	Very Moist		**Water Seepage at 18 feet**
20									
	2.5	23.5-25.0	SS	2	4	4	Moist		
25									
	2.0	28.5-30.0	SS	2	3	3	Very Moist		
30									
	4.5+	33.5-35.0	SS	15	20	28	Moist		
								35.0	BOTTOM OF BORING: 35 feet

*** The stratification lines represent the approximate boundary between soil types and the transition may be gradual.**

TEST BORING LOG

PROJECT NAME **Scarborough Senior Living - St. Clair Avenue - Columbus, Ohio** BORING NO. **B-5**

PROJ. SURF. ELEV.

CLIENT **National Church Residences of Scarborough, LLC** NO. **23-G-28545** DATE DRILLED **1/11/2024**

GROUND WATER OBSERVATION

4.0 FEET BELOW SURFACE AT COMPLETION

_____ FEET BELOW SURFACE AT 24 HOURS

_____ FEET BELOW SURFACE AT ____ HOURS

Proportions Used

Trace	Less than 5%
Few	5 to 10%
Little	15 to 25%
Some	30 to 45%
Mostly	50 to 100%

140 lb Wt. x 30" fall on 2" O.D. Sampler

Cohesionless Density

0 - 10	Loose
10 - 30	Medium Dense
30 - 50	Dense
50 +	Very Dense

Cohesive Consistency

0 - 4	Soft
4 - 8	Medium Stiff
8 - 15	Stiff
15 - 30	Very Stiff
30 +	Hard

LOCATION OF BORING **See Boring Location Plan**

DEPTH	Pocket Penetrometer (tsf)	Sample Depths From To	Type of Sample	Blows per 6" on Sampler From To 0-6	6-12	12-18	Moisture Density or Consist.	Strata Change Depth*	SOIL IDENTIFICATION Remarks include color, type of soil, etc. Rock-color, type, condition, hardness
								0.4	4" of Asphalt over 7" of Stone
	2.0	1.0-3.0	SS	2	3	34	Moist	0.9	Stained to Brown Mottled Gray Lean Clay (CL) - moderate to high plasticity, few sand, few gravel; staining extended to about 4 feet
	1.0	3.0-5.5	SS	2	3	32	Very Moist		
5								7.0	
	4.0	8.5-10.0	SS	5	6	7	Very Moist to Moist		Brown Sandy Lean Clay (CL); glacial till - low to moderate plasticity, little to some sand, few gravel; frequent saturated sand and silt layers **Water Seepage at 8 feet**
10								11.0	
	4.0	13.5-15.0	SS	5	6	6	Moist		Gray Sandy Lean Clay to Sandy Lean Clay with Gravel (CL); glacial till - moderate plasticity, little to some sand, few to little gravel
15									
	N/R	18.5-20.0	SS	15	16	17	Moist		Silty Sand and Gravel lens
20									
	4.5+	23.5-25.0	SS	16	20	24	Moist		
25									
	4.5+	28.5-30.0	SS	19	21	22	Moist		
30									
	4.5+	33.5-35.0	SS	20	24	30	Moist		
								35.0	BOTTOM OF BORING: 35 feet

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TEST BORING LOG

PROJECT NAME **Scarborough Senior Living - St. Clair Avenue - Columbus, Ohio** BORING NO. **B-6**

PROJ. SURF. ELEV.

CLIENT **National Church Residences of Scarborough, LLC** NO. **23-G-28545** DATE DRILLED **1/11/2024**

GROUND WATER OBSERVATION

None FEET BELOW SURFACE AT COMPLETION

_____ FEET BELOW SURFACE AT 24 HOURS

_____ FEET BELOW SURFACE AT _____ HOURS

Proportions Used

Trace	Less than 5%
Few	5 to 10%
Little	15 to 25%
Some	30 to 45%
Mostly	50 to 100%

140 lb Wt. x 30" fall on 2" O.D. Sampler

Cohesionless Density

0 - 10	Loose
10 - 30	Medium Dense
30 - 50	Dense
50 +	Very Dense

Cohesive Consistency

0 - 4	Soft
4 - 8	Medium Stiff
8 - 15	Stiff
15 - 30	Very Stiff
30 +	Hard

LOCATION OF BORING **See Boring Location Plan**

DEPTH	Pocket Penetrometer (tsf)	Sample Depths From To	Type of Sample	Blows per 6" on Sampler From To 0-6	6-12	12-18	Moisture Density or Consist.	Strata Change Depth*	SOIL IDENTIFICATION Remarks include color, type of soil, etc. Rock-color, type, condition, hardness
								0.3	3" of Asphalt over 5" of Stone
	--	1.0-3.0	SS	5	4	3	Moist	0.7	FILL: Mixture of Stained Lean Clay (CL) and Dark Brown/Black Silty Sand (SM) - trace construction debris
				4				3.0	
	4.5+	3.0-5.5	SS	3	4	5	Moist	4.0	Brown Mottled Gray Lean Clay (CL) - moderate to high plasticity, few sand
				5					
5									Brown Sandy Lean Clay (CL); glacial till - low to moderate plasticity, little to some sand, few gravel
	4.5+	8.5-10.0	SS	5	5	6	Moist		
10								10.0	Gray Sandy Lean Clay with Gravel (CL); glacial till - low to moderate plasticity, little sand, little gravel
	4.5+	13.5-15.0	SS	9	9	10	Moist		
15									
	4.5+	18.5-20.0	SS	15	21	23	Moist		
20									
	4.5+	23.5-25.0	SS	15	15	18	Moist		
25									
	4.5+	28.5-30.0	SS	13	16	22	Moist		
30									
	4.5+	33.5-35.0	SS	19	20	21	Moist		
								35.0	BOTTOM OF BORING: 35 feet

*** The stratification lines represent the approximate boundary between soil types and the transition may be gradual.**

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TEST BORING LOG

PROJECT NAME **Scarborough Senior Living - St. Clair Avenue - Columbus, Ohio** BORING NO. **B-7**

PROJ. SURF. ELEV.

CLIENT **National Church Residences of Scarborough, LLC** NO. **23-G-28545** DATE DRILLED **1/10/2024**

GROUND WATER OBSERVATION

21.0 FEET BELOW SURFACE AT COMPLETION

_____ FEET BELOW SURFACE AT 24 HOURS

_____ FEET BELOW SURFACE AT ____ HOURS

Proportions Used

Trace	Less than 5%
Few	5 to 10%
Little	15 to 25%
Some	30 to 45%
Mostly	50 to 100%

140 lb Wt. x 30" fall on 2" O.D. Sampler

Cohesionless Density

0 - 10	Loose
10 - 30	Medium Dense
30 - 50	Dense
50 +	Very Dense

Cohesive Consistency

0 - 4	Soft
4 - 8	Medium Stiff
8 - 15	Stiff
15 - 30	Very Stiff
30 +	Hard

LOCATION OF BORING **See Boring Location Plan**

DEPTH	Pocket Penetrometer (tsf)	Sample Depths From To	Type of Sample	Blows per 6" on Sampler 0-6	6-12	12-18	Moisture Density or Consist.	Strata Change Depth*	SOIL IDENTIFICATION Remarks include color, type of soil, etc. Rock-color, type, condition, hardness
								0.3	3" of Asphalt over 9" of Stone
	2.0	1.0-3.0	SS	3 5	4	5	Moist to Very Moist	1.0	Stained to Brown Mottled Gray Lean Clay (CL) - moderate to high plasticity, few sand, few gravel
	1.0	3.0-5.5	SS	1 3	2	3	Very Moist		
5								7.0	
	3.5	8.5-10.0	SS	4	5	5	Moist		Brown Sandy Lean Clay (CL); glacial till - low to moderate plasticity, little to some sand, few gravel; frequent saturated sand and silt layers
10								12.0	**Water Seepage at 11 feet**
	4.5+	13.5-15.0	SS	4	6	11	Moist		Gray Sandy Lean Clay with Gravel (CL); glacial till - low to moderate plasticity, little sand, little gravel
15									
	4.5+	18.5-20.0	SS	16	19	26	Moist		
20									Sand and Gravel lenses
	4.5+	23.5-25.0	SS	10	17	28	Moist		
25									
	4.5+	28.5-30.0	SS	20	31	31	Moist		
30									
	4.5+	33.5-35.0	SS	17	17	32	Moist		
								35.0	BOTTOM OF BORING: 35 feet

*** The stratification lines represent the approximate boundary between soil types and the transition may be gradual.**

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TEST BORING LOG

PROJECT NAME **Scarborough Senior Living - St. Clair Avenue - Columbus, Ohio** BORING NO. **B-8**

PROJ. SURF. ELEV.

CLIENT **National Church Residences of Scarborough, LLC** NO. **23-G-28545** DATE DRILLED **1/11/2024**

GROUND WATER OBSERVATION

None FEET BELOW SURFACE AT COMPLETION

_____ FEET BELOW SURFACE AT 24 HOURS

_____ FEET BELOW SURFACE AT ____ HOURS

Proportions Used

Trace	Less than 5%
Few	5 to 10%
Little	15 to 25%
Some	30 to 45%
Mostly	50 to 100%

140 lb Wt. x 30" fall on 2" O.D. Sampler

Cohesionless Density

0 - 10	Loose
10 - 30	Medium Dense
30 - 50	Dense
50 +	Very Dense

Cohesive Consistency

0 - 4	Soft
4 - 8	Medium Stiff
8 - 15	Stiff
15 - 30	Very Stiff
30 +	Hard

LOCATION OF BORING **See Boring Location Plan**

DEPTH	Pocket Penetrometer (tsf)	Sample Depths From To	Type of Sample	Blows per 6" on Sampler From To 0-6	6-12	12-18	Moisture Density or Consist.	Strata Change Depth*	SOIL IDENTIFICATION Remarks include color, type of soil, etc. Rock-color, type, condition, hardness
								0.2	2" of Asphalt over 8" of Stone
	1.0	1.0-3.0	SS	3 4	3	6	Moist to Very Moist	0.8 3.0	FILL: Dark Stained/Black Lean Clay (CL) - trace glass and brick
	2.0	3.0-5.5	SS	3 3	3	3	Very Moist	7.0	Brown Mottled Gray Lean Clay (CL) - moderate plasticity, few sand
5									
	--	8.5-10.0	SS	3	3	4	Very Moist to Wet	12.0	Brown Sandy Lean Clay (CL); glacial till - low to moderate plasticity, little to some sand, few gravel; frequent saturated sand and silt layers **Water Seepage at 9 feet**
10									
	4.5+	13.5-15.0	SS	11	11	15	Moist		Gray Sandy Lean Clay with Gravel (CL); glacial till - low to moderate plasticity, little sand, little gravel
15									
	4.5+	18.5-20.0	SS	10	13	14	Moist		
20									
	4.5+	23.5-25.0	SS	14	16	17	Moist		
25									
	4.5+	28.5-30.0	SS	19	19	19	Moist		
30									
	4.5+	33.5-35.0	SS	27	26	21	Moist		
								35.0	BOTTOM OF BORING: 35 feet

*** The stratification lines represent the approximate boundary between soil types and the transition may be gradual.**

TEST BORING LOG

PROJECT NAME **Scarborough Senior Living - St. Clair Avenue - Columbus, Ohio** BORING NO. **B-9**

PROJ. SURF. ELEV.

CLIENT **National Church Residences of Scarborough, LLC** NO. **23-G-28545** DATE DRILLED **1/11/2024**

GROUND WATER OBSERVATION

None FEET BELOW SURFACE AT COMPLETION

_____ FEET BELOW SURFACE AT 24 HOURS

_____ FEET BELOW SURFACE AT ____ HOURS

Proportions Used

Trace	Less than 5%
Few	5 to 10%
Little	15 to 25%
Some	30 to 45%
Mostly	50 to 100%

140 lb Wt. x 30" fall on 2" O.D. Sampler

Cohesionless Density

0 - 10	Loose
10 - 30	Medium Dense
30 - 50	Dense
50 +	Very Dense

Cohesive Consistency

0 - 4	Soft
4 - 8	Medium Stiff
8 - 15	Stiff
15 - 30	Very Stiff
30 +	Hard

LOCATION OF BORING **See Boring Location Plan**

DEPTH	Pocket Penetrometer (tsf)	Sample Depths From To	Type of Sample	Blows per 6" on Sampler From To 0-6	6-12	12-18	Moisture Density or Consist.	Strata Change Depth*	SOIL IDENTIFICATION Remarks include color, type of soil, etc. Rock-color, type, condition, hardness
								0.2	2" of Asphalt over 9" of Stone
								0.9	
	2.0	1.0-3.0	SS	4	4	5	Very Moist		Stained to Brown Mottled Gray Lean Clay (CL) - moderate to high plasticity, few sand, few gravel
				5					
	4.5	3.0-5.5	SS	2	3	4	Moist		
				5					
								4.5	
5									Brown Sandy Lean Clay (CL); glacial till - low to moderate plasticity, little to some sand, few gravel; frequent saturated sand and silt layers
	3.0	8.5-10.0	SS	5	4	7	Moist		
10								10.0	
									BOTTOM OF BORING: 10 feet
15									

*** The stratification lines represent the approximate boundary between soil types and the transition may be gradual.**

TEST BORING LOG

PROJECT NAME **Scarborough Senior Living - St. Clair Avenue - Columbus, Ohio** BORING NO. **B-10**

PROJ. SURF. ELEV.

CLIENT **National Church Residences of Scarborough, LLC** NO. **23-G-28545** DATE DRILLED **1/11/2024**

GROUND WATER OBSERVATION

None FEET BELOW SURFACE AT COMPLETION

_____ FEET BELOW SURFACE AT 24 HOURS

_____ FEET BELOW SURFACE AT ____ HOURS

Proportions Used

Trace	Less than 5%
Few	5 to 10%
Little	15 to 25%
Some	30 to 45%
Mostly	50 to 100%

140 lb Wt. x 30" fall on 2" O.D. Sampler

Cohesionless Density

0 - 10	Loose
10 - 30	Medium Dense
30 - 50	Dense
50 +	Very Dense

Cohesive Consistency

0 - 4	Soft
4 - 8	Medium Stiff
8 - 15	Stiff
15 - 30	Very Stiff
30 +	Hard

LOCATION OF BORING **See Boring Location Plan**

DEPTH	Pocket Penetrometer (tsf)	Sample Depths From To	Type of Sample	Blows per 6" on Sampler From To 0-6	6-12	12-18	Moisture Density or Consist.	Strata Change Depth*	SOIL IDENTIFICATION Remarks include color, type of soil, etc. Rock-color, type, condition, hardness
								0.2	2" of Asphalt over 7.5" of Stone
	1.5	1.0-3.0	SS	2 7	3	4	Moist	0.8	FILL: Dark Stained/Black Lean Clay (CL) - trace glass and brick
	2.0	3.0-5.5	SS	2 5	3	5	Moist	4.0	
5									Gray/Olive to Brown Mottled Gray Lean Clay (CL) - moderate to high plasticity, few sand
								8.0	
	3.5	8.5-10.0	SS	3	2	4	Moist		Brown Sandy Lean Clay (CL); glacial till - low to moderate plasticity, little to some sand, few gravel; frequent saturated sand and silt layers
10								10.0	
									BOTTOM OF BORING: 10 feet
15									

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SECTION 03 20 00

CONCRETE REINFORCING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Reinforcing steel for cast-in-place concrete.

B. Supports and accessories for steel reinforcement.

1.02 RELATED REQUIREMENTS

A. Section 03 3000 - Cast-in-Place Concrete.

B. Section 04 2000 - Unit Masonry: Reinforcement for masonry.

1.03 REFERENCE STANDARDS

A. ACI 301 - Specifications for Structural Concrete 2016.

B. ACI 318 - Building Code Requirements for Structural Concrete and Commentary 2014 (Errata 2018).

C. ACI SP-66 - ACI Detailing Manual 2004.

D. ASTM A82/A82M - Standard Specification for Steel Wire, Plain, for Concrete Reinforcement; 2007.

E. ASTM A184/A184M - Standard Specification for Welded Deformed Steel Bar Mats for Concrete Reinforcement 2019.

F. ASTM A185/A185M - Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete; 2007.

G. ASTM A497/A497M - Standard Specification for Steel Welded Wire Reinforcement, Deformed, for Concrete; 2007.

H. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement 2020.

I. ASTM A1064/A1064M - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete 2018a.

J. CRSI (DA4) - Manual of Standard Practice 2009.

K. CRSI (P1) - Placing Reinforcing Bars 2011.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Comply with requirements of ACI SP-66. Include bar schedules, shapes of bent bars, spacing of bars, and location of splices.

1. Prepare shop drawings under seal of a Professional Structural Engineer experienced in design of work of this type and licensed in State of Ohio.

1.05 QUALITY ASSURANCE

A. Perform work of this section in accordance with ACI 301.

1. Maintain one copy of each document on project site.

PART 2 PRODUCTS

2.01 REINFORCEMENT

A. Reinforcing Steel: ASTM A615/A615M Grade 60 (420).
   1. Plain billet-steel bars.
   2. Unfinished.

B. Stirrup Steel: ASTM A1064/A1064M steel wire, unfinished.

C. Steel Welded Wire Reinforcement (WWR): Galvanized, deformed type; ASTM A1064/A1064M.
   1. Form: Flat Sheets.
   2. WWR Style: 4 x 8-W6 x W10.
   3. Wire Gage: _2.1_x_2.1_.

D. Use Fiber Reinforcement at all slabs to receive floor finish: Polypropylene fibers engineered and designed for secondary reinforcement of concrete slabs, complying with ASTM C 1116, Type III, 1 1/2 inch long, mixed at a dosage rate of 1.5 pounds per cubic yard of concrete.

E. Reinforcement Accessories:
   1. Tie Wire: Annealed, minimum 16 gage, 0.0508 inch.
   2. Chairs, Bolsters, Bar Supports, Spacers: Sized and shaped for adequate support of reinforcement during concrete placement.

2.02 RE-BAR SPLICING:

A. Coupler Systems: Mechanical devices for splicing reinforcing bars; capable of developing full steel reinforcing design strength in tension and compression.

B. Dowel Bar Splicer with Dowel-Ins: Mechanical devices for connecting dowels; capable of developing full steel reinforcing design strength in tension and compression.

C. Taper Tie Hole Plug: Mechanical device for plugging tie holes; anchors optional flush or recessed grout.

D. Grout: Cementitious, non-metallic, non-shrink grout for use with manufacturer's grout sleeve reinforcing bar coupler system.

2.03 FABRICATION

A. Fabricate concrete reinforcing in accordance with CRSI (DA4) - Manual of Standard Practice.

B. Welding of reinforcement is not permitted.

PART 3 EXECUTION

3.01 PLACEMENT

A. Place, support and secure reinforcement against displacement. Do not deviate from required position.

B. Do not displace or damage vapor barrier.

C. Accommodate placement of formed openings.

D. Maintain concrete cover around reinforcing as follows:
   1. Walls (exposed to weather or backfill): 3 inch.
   2. Footings and Concrete Formed Against Earth: 3 inch.

3.02 FIELD QUALITY CONTROL

A. An independent testing agency, as specified in Section 01 4000 -

Quality Requirements, will inspect installed reinforcement for conformance to contract documents before concrete placement.

END OF SECTION

SECTION 03 30 00

CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.01 DESCRIPTION

A. Basic Specification: All work of this Section shall conform to the requirements of ACI 301, "Specifications for Structural Concrete," except as specifically modified herein. Numbers in parentheses (0.00) indicate a related paragraph of ACI 301.

B. Work Included: All cast-in-place concrete work shown on the Drawings and required by these Specifications, including formwork, reinforcement, concrete materials, mix design, placement procedures and finishes. Allow for the installation of cast-in-place items furnished under other Sections. Install anchor rods for structural steel. Provide and install grout under steel column base plates and under steel beam bearings.

C. Provide concrete pads, piers, curbs, and bases required for equipment of all trades. Coordinate dimensions and details with requirements of equipment being supplied, prior to placing concrete.

D. Coordinate the work of other trades who are to provide and install items (sleeves, piping, conduit, inserts, etc.) to be cast in the concrete. Place no concrete until all such items are in place.

E. Inspection and testing services required to establish mix designs are to be performed by an agency retained by the Contractor (1.6.2). Other services required by this Section are to be performed by an agency retained by the Owner (1.6.3). Provide facilities for storage and curing of specimens molded by the Owner's agency (1.6.3.2.d).

F. Related Work Specified Elsewhere: The general provisions of the Contract apply to the work of this Section as though reproduced herein. Carefully examine all other Sections and all Drawings for related work; which includes but is not limited to:

1.	Quality Requirements:	Section 01 40 00
2.	Drilled Concrete Piers:	Section 31 63 29
3.	Structural Steel Framing:	Section 05 12 00

1.02 QUALITY ASSURANCE

A. All cast-in-place concrete construction shall conform with the governing codes including the latest adopted editions of the standards and material specifications referenced herein.

B. Reference Standards:

1. ACI 301, "Specifications For Structural Concrete."
2. ACI 318, "Building Code Requirements for Structural Concrete."
3. ACI Detailing Manual, (SP-66).
4. ACI 347, "Guide to Formwork for Concrete."
5. CRSI "Placing Reinforcing Bars," and "Manual of Standard Practice."
6. ACI 305, "Hot Weather Concreting."
7. ACI 306, "Cold Weather Concreting."

C. Materials and installed work may require testing and retesting at any time during the progress of work. Tests, including retesting of non-conforming or deficient materials or

installed work, shall be performed at Contractor's expense.

1.03 SUBMITTALS

A. Submit for approval the name of the agency proposed for the required inspection and testing services. All of the required testing is to be performed by personnel employed by the proposed agency (1.6.1).

B. Submit a mix design for each class of concrete required (1.6.2). Submittals to comply with appropriate methods listed in ACI 301 (4.1 and 4.2). Indicate whether mixes have been designed for pumping.

C. Submit shop drawings for all reinforcing. Indicate strength, size, and details for all bar reinforcing, and style and specification of all welded wire fabric (3.1.1).

D. Submit, on request only, product literature for admixtures, curing compounds and patching mortar proposed for use.

E. Submit reports of all required testing and inspection (1.6.2).

1.04 FIELD REFERENCE MANUALS

A. Provide at least one copy of the ACI Field Reference Manual, SP-15, and one copy of CRSI's "Placing Reinforcing Bars" and "Manual of Standard Practice," in the field office at all times (1.3.3).

PART 2 - PRODUCTS

2.01 FORM MATERIALS

A. Smooth-Formed Finished Concrete: Plywood, metal or other approved panel materials that provide continuous, true and smooth concrete surfaces.

B. Rough Formed Finished Concrete: Plywood, lumber, metal or other approved material.

C. Chamfer Strips: Wood, metal, PVC or rubber strips, 3/4 inch x 3/4 inch, minimum.

D. Formwork Release Agent: Commercially manufactured form release agents that will prevent formwork absorption of moisture, prevent bond with concrete, not stain concrete surfaces and will not impair subsequent treatment of concrete surfaces.

E. Form Ties: Factory fabricated, adjustable length, removable or snap off metal form ties, designed to prevent form deflection and to prevent spalling concrete upon removal. Provide ties that will leave no metal closer than 1-1/2 inches from exposed surfaces and that will leave holes not larger than 1 inch diameter in concrete surfaces.

2.02 REINFORCING (3.2.1)

A. Deformed Bars: ASTM A615 (including Supplementary Requirements) or A617. Minimum yield strength to be 60 ksi. Bars to be welded are to be per A706.

B. Welded Wire Fabric: ASTM A1064. Provide in sheet form (not rolls).

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

1. For concrete surfaces exposed to view where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected or CRSI Class 2 stainless-steel bar

supports.

D. Positive Connection Splices: Welded or mechanical splices with splice capacity greater than, or equal to, 125% of the specified yield strength of the reinforcing bars to be spliced.

2.03 CONCRETE MATERIALS

A. Portland Cement: ASTM C595 Type 1L (4.2.1.1.b).

B. Water: Potable.

C. Aggregates: ASTM C33. Use size No. 57 coarse aggregate, unless otherwise indicated (4.2.1.2).

D. Fly Ash: ASTM C618, Class F.

2.04 ADMIXTURES

A. All admixtures shall be certified by the manufacturer to contain not more than 0.1 percent water-soluble chloride ions by mass of cementitious material and shall be compatible with other admixtures and cementitious materials.

B. Water-Reducing: ASTM C494, Type A or D.

C. Superplasticizer: ASTM C494, Type F or G.

D. Air-Entraining: ASTM C260.

E. Accelerating: ASTM C494, Type C or E, containing no more chlorides than are present in municipal drinking water.

F. Synthetic Fiber Reinforcement: ASTM C1116.

G. Calcium chloride is not permitted (4.2.2.5).

2.05 RELATED MATERIALS

A. Premolded Expansion Joint Filler: ASTM D1751 (2.2.1.4).

B. Curing Compound: Comply with ASTM C309, Type 1, Class B (clear), except moisture loss not to exceed 0.39 kg/sq. m. in 72 hours. Compound shall comply with EPA's VOC requirements. Apply at the manufacturer's written recommended application rate. Must be compatible with adhesive specified for floor finishes or be removed by the Contractor prior to applying floor finish.

C. Grout for Masonry Core Fill: ASTM C476, coarse type or fine type, placed per ACI 530.1, Paragraph 3.5.

D. Non-Shrink, Non-Metallic Grout Under Bearing Elements: Conform to ASTM C1107.

E. Bonding Agent: Conform to ASTM C1059, Type II. No thinner than 75 square feet per gallon.

F. Sealer: Clear membrane-forming compound which will not yellow. Must be formulated for the intended application, either interior or exterior and applied per the manufacturer's written recommendations. Must comply with EPA VOC requirements and be compatible with the curing compound used.

G. Joint Sealant: Use 1-component polyurethane conforming to ASTM C920, Type S, Grade NS, Class 25, with backer rod as required.

2.06 CONCRETE MIXES

A. The following classes of concrete are required (4.2.2.8):

1. Class I – footings and piers: Minimum f'c = 3,500 psi.
2. Class II - interior slabs on grade and all interior concrete not otherwise identified. Minimum f'c = 3,500 psi; water-reducer required. Minimum cement content 517 lbs. per cubic yard.
3. Class III - exterior slabs on grade and all exterior concrete not otherwise identified. Minimum f'c = 4,500 psi; air-entraining admixture and water-reducer required. Maximum water-cement ratio: 0.45, air content: 6 + 1.5% (4.2.2.4).
4. Class IV - backfill below footings. Minimum f'c = 1,500 psi (lean mix).

B. Flyash is permitted in all Classes, but if used, shall be a minimum of 15% and a maximum of 25% of the total weight of cementitious materials.

C. Class IV concrete may be site mixed, all other concrete is to be ready-mixed (4.3.1.1 and 4.3.1.2). All admixtures are to be added at the batch plant, except that superplasticizer, if used, is to be added at the site.

D. Slump (4.2.2.2):

1. Design concrete mixes for a maximum slump of 4 inches, unless a superplasticizer is to be used.
2. If a superplasticizer is to be used, design mixes for a slump of 2 inches - 3 inches before its addition; maximum slump permitted after its addition is 8 inches.

E. Synthetic fiber reinforcement shall be used in strict accordance with the manufacturer's recommendations. Dosage rate shall be as recommended by the manufacturer, but not less than 1 pound per cubic yard for nylon fibers and not less than 1-1/2 pounds per cubic yard for polypropylene fibers.

PART 3 - EXECUTION

3.01 SURFACE CONDITIONS

A. Verify that excavations are free of water and ice, are of the required dimensions and have been approved by the Soils Engineer prior to placing concrete (5.3.1).

B. Determine field conditions by actual measurement.

C. Notify the Architect not less than 24 hours in advance of placing concrete. Place concrete only when the Architect is present, unless this requirement is specifically waived.

3.02 FORMWORK

A. Footings may be cast against earth cuts when soil conditions permit (2.2.2.3).

B. Design, erect, support, brace, and maintain formwork to support vertical and lateral, static and dynamic loads that might be applied until such loads can be supported by the concrete structure. Construct formwork so concrete members and structures are of correct size, shape, alignment, elevation, and position. Maintain formwork construction tolerances complying with ACI 347.

C. Design formwork to be readily removable without impact, shock, or damage to cast-in-place concrete surfaces and adjacent materials.

D. Construct forms to sizes, shapes, lines, and dimensions shown and to obtain accurate alignment, location, grades, level, and plumb work in finished structures. Provide for openings, offsets, keyways, recesses, moldings, rustications, reglets, chamfers, blocking,

screeds, bulkheads, anchorages and inserts, and other features required in work. Use selected materials to obtain required finishes. Solidly butt joints and provide backup at joints to prevent leakage of cement paste. Chamfer all exposed corners and edges.

E. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush plates or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces where slope is too steep to place concrete with bottom forms only. Kerf wood inserts for forming keyways, reglets, recesses, and the like, for easy removal.

F. Provide temporary openings where interior area of formwork is inaccessible for clean out, for inspection before concrete placement, and for placement of concrete. Securely brace temporary openings and set tightly to forms to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.

3.03 REINFORCING

A. Comply with Concrete Reinforcing Steel Institute's recommended practice for "Placing Reinforcing Bars," for details and methods of reinforcement placement and supports and as herein specified.

B. Clean reinforcement of loose rust and mill scale, earth, ice, and other materials that reduce or destroy bond with concrete.

C. Accurately position, support, and secure reinforcement against displacement by formwork, construction or concrete placement operations. Locate and support reinforcing by metal chairs, runners, bolsters, spacers, and hangers, as approved by Architect.

3.04 EMBEDDED ITEMS

A. It is solely the contractor's responsibility to coordinate with all trades for the setting of sleeves, anchors, inserts and other embedded items indicated in the Contract Documents. Set and build into work, anchorage devices and other embedded items required for other work attached to, or supported by, cast-in-place concrete. Use setting drawings, diagrams, instructions, and directions provided by suppliers of items to be attached. Embedded items shall not displace reinforcing. Provide no sleeves or openings in structural members unless shown on the structural drawings or as approved by the Architect. Do not place concrete before embedded items are in place to the satisfaction of the responsible trade.

B. Install embedded conduit, pipes and sleeves subject to the following limitations:

1. Do not embed aluminum without prior approval of coating material.
2. Do not displace reinforcing steel.
3. Limit the outside dimension of conduits and pipes to 1/3 slab thickness. Where conduits cross, maintain the same minimum concrete cover as required for reinforcing bars.
4. Maintain a center-to-center spacing of at least three diameters of conduit or pipe.

3.05 DELIVERY AND PLACEMENT

A. Preparation Before Placement:

1. Remove all debris from forms.
2. Do not use additives or salts to remove ice.
3. In cold weather, maintain temperature of forms and reinforcing such that concrete temperature can be kept within the specified range.

B. Delivery:

1. Conform to ASTM C94.
2. ASTM C94 requires discharge within 1-1/2 hours or 300 revolutions, whichever occurs first, after the introduction of water to cement and aggregates, or the introduction of cement to the aggregates. The Architect may require an earlier discharge during hot weather or when high-early strength cement is being used (4.3.2.2).
3. Place concrete at the maximum slump for which the mix was designed with a tolerance of up to 1 inch above the maximum.

C. Placement: Before placing concrete, verify that installation of formwork, reinforcement and embedded items is complete and that required inspections have been performed.

1. Comply with ACI 304 “Recommended Practice for Measuring, Mixing, Transporting and Placing Concrete” and as specified herein.
2. Place within 6 feet of final position. Spreading with vibrators is prohibited.
3. Maximum free fall without chutes or elephant trunks to be 5 feet.

3.06 JOINTING

A. Interior Slabs on Grade:

1. Locate control and construction joints as shown on the Drawings. In the absence of information on Drawings, locate at openings, walls, columns, grid lines, inside corners and at 12 feet on center generally. Schedule slab placements and sawcutting operations such that sawing is completed prior to onset of shrinkage cracking (5.3.5).
2. Provide isolation joints at columns (1/2 inch thick) and at walls (1/4 inch thick). Where isolation joint will be exposed to view, set top of joint filler below top of slab a distance equal to the filler thickness, to receive sealant. Where not exposed to view, set top of filler flush with top of slab.
3. Where joints are exposed to view in the finished building, provide joint sealant.

B. Exterior Slabs on Grade: Locate joints as shown on the Drawings. In the absence of information on the Drawings, provide the following:

1. Expansion Joints: Full depth, with 1/2-inch joint filler, where slabs abut vertical surfaces, at intersections of sidewalks, at abrupt changes in width and at a spacing not exceeding 30 feet.
2. Control Joints: Tooled, 7/8 inch deep, 4'-0" to 6'-0" on center between expansion joints.

C. Construction Joints: Construct joints true to line with formed keyways perpendicular to surface plane of concrete. Construction joints are shown on the drawings. The Contractor shall submit all joint locations and joint details with the reinforcing steel shop drawings for all construction joints, including additional joints not shown on the drawings.

1. Reinforcement shall be continuous across construction joints.
2. Place joints perpendicular to main reinforcement.
3. All construction joints shall be roughened and fully bonded. Use a bonding agent at all construction joints.

3.07 FINISHES

A. Schedule of finishes on flatwork is as follows:

1. Typical interior floor areas to receive adhesive-applied finish, or carpet, or to remain exposed: troweled finish (5.3.4.2.c).
2. Interior floor areas to receive finish in cementitious setting bed: floated finish (5.3.4.2.b).
3. Exterior slabs: broom finish (5.3.4.2.d).

3.08 FINISHING TOLERANCES

A. Conform to F-number requirements noted below and as described in ASTM E1155 for all interior slabs (5.3.4.3):

1. Interior slabs-on-grade with resilient flooring: FF-32/ FL-25 for any individual floor section.
2. All other interior slabs-on-grade: FF-25/FL-20 minimum overall for composite of all measured values; FF-18/FL-15 minimum for any individual floor section.
3. All other interior slabs: FF-25 minimum overall for composite of all measured values; FF-18 minimum for any individual section.

B. Take remedial measures if flatness and levelness testing indicates either of the following conditions exists:

1. The entire floor composite value, when installation is complete, measures less than either of the specified overall F-numbers.
2. Any individual floor section measures less than either of the specified minimum section F-numbers.

C. Individual floor sections for floor tolerance testing purposes shall be bound by the following that provide the smallest sections: construction joints, control joints, column lines and half-column lines. Any bay not conforming to the above flatness and levelness requirements is subject to repair or removal and replacement and retesting at no additional expense to the Owner (1.7.1).

D. Obtain written approval of the Architect and Engineer for remedial measures proposed before implementing measures.

E. Finish all exterior slabs with a floated finish that will meet conventional straightedge tolerance requirements of ACI 117, then refloat the slab immediately to a uniform texture. Immediately after, give the concrete surface a coarse transverse scored texture by drawing a broom across the surface (5.3.4.2.b and 5.3.4.2.d).

3.09 CURING AND PROTECTION

A. Temperature:

1. When the average air temperature is expected to be less than 40 degrees for more than three consecutive days, temperature of concrete as placed is to be between 50 and 90 degrees F (55 and 90 degrees F for sections less than 12 inches thick). Maintain concrete temperature within these limits for the full curing period of seven days. (4.2.2.6, 5.3.1.6, 5.3.2.1.b and 5.3.6.1).

B. Curing:

1. Interior slab areas which will receive finish in cementitious setting bed are to be moist-cured, without the use of a curing compound (5.3.6.4.a through 5.3.6.4.d).
2. Surfaces which are to receive a sealer are to be moist-cured, without the use of a curing compound (5.3.6.4.a through 5.3.6.4.d).
3. All other slab areas may be either moist-cured or receive an application of curing

compound (5.3.6.4.a through 5.3.6.4.f).

4. Whichever curing method is used, it is to commence immediately after disappearance of water sheen, and continue for at least seven days (5.3.6.1). Do not allow curing to be delayed overnight.
5. Prevent excessive moisture loss from formed surfaces (5.3.6.3). If forms are removed before seven days have elapsed, cure the formed surfaces by moist-curing or application of curing compound for the remainder of the curing period.
6. All exterior slabs are to receive an application of sealer prior to the completion of construction.
7. Interior slabs which remain exposed are to receive an application of sealer prior to the completion of construction.

3.10 GROUTING

A. Install grout below bearing plates, setting plates and column base plates only after the steel is plumbed. The use of leveling plates at column bases is prohibited.

B. Install grout per the recommendations of the manufacturer.

3.11 CONCRETE SURFACE REPAIRS

A. Repair any slabs which do not meet the finish requirements. The Architect will determine whether grinding, filling cracks, patching and leveling, or removal and replacement procedures are required.

B. Patching Mortar: Mix dry-pack patching mortar, consisting of one part Portland cement to two and one-half parts fine aggregate passing a No. 16 sieve, using only enough water for handling and placing.

C. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.

1. Repair finished surfaces containing defects. Surface defects include spalls, popouts, honeycombs, rock pockets, grazing and cracks in excess of 0.01 inch wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.
2. After concrete has cured at least 14 days, correct high areas by grinding.
3. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete.
4. Correct other low areas scheduled to receive floor coverings with a repair underlayment. Prepare, mix, and apply repair underlayment and primer according to manufacturer’s written instructions to produce a smooth, uniform, plane and level surface. Feather edges to match adjacent floor elevations.
5. Correct other low areas scheduled to remain exposed with a repair topping. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch to match adjacent floor elevations. Prepare, mix, and apply repair topping and primer according to manufacturer’s written instructions to produce a smooth, uniform, plane and level surface.
6. Repair defective areas, except random cracks and single holes 1 inch or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least 3/4 inch clearance all around. Dampen concrete surfaces in contact with patching concrete

and apply bonding agent. Mix patching concrete of same materials and mix as original concrete except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.

7. Repair random cracks and single holes 1 inch or less in diameter with patching mortar. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.

D. Perform structural repairs of concrete, subject to the Architect's approval, using epoxy adhesive and patching mortar.

E. Repair materials and installation not specified above may be used, subject to the Architect's approval.

3.12 FIELD QUALITY CONTROL

A. Obtain concrete for required tests at point of placement (1.6.3.3).

B. For each concrete Class, perform one strength test for each 150 cubic yards or 5,000 square feet of surface area of slabs or walls or fraction thereof, for one day placements (1.6.3.2.d).

C. Determine slump for each strength test (1.6.3.2.d).

D. Determine air content for each strength test of air-entrained concrete (1.6.3.2.d).

E. Determine concrete temperature for each strength test (1.6.3.2.d).

F. Do not place concrete when slump, air content or temperature vary from allowable (1.6.7).

G. Interior floor slab finished surfaces shall be tested for flatness and levelness in accordance with ASTM E1155.

H. Individual floor sections for floor tolerance testing purposes shall be bound by the following that provide the smallest sections: construction joints, control joints, column lines and half-column lines.

I. Floor tolerance tests shall be performed (and all defective areas identified) within 24 hours after slab placement and reported to all parties as soon as possible, but not later than 72 hours after installation. Shored elevated slabs shall be tested prior to removal of shoring.

J. Maintain records of all tests, indicating date and time of placement and exact location of the structure represented by each test. Test results will be reported in writing to Architect/Engineer, the Owner, and Contractor within 24 hours after tests. Reports of compressive strength test shall contain the project identification name and number, date of concrete placement, name of concrete testing service, concrete type and class, location of concrete batch in structure, design compressive strength at 28 days, concrete mix proportions and materials; compressive strength, breaking load and type of break for both 7-day tests and 28-day tests.

K. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted but shall not be used as the sole basis for acceptance or rejection.

L. Additional Tests: The testing service will make additional test of in-place concrete when test results indicate specified concrete strengths and other characteristics have not been attained in the structure, as directed by Architect/Engineer. Testing service may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42, or

by other methods as directed. Contractor shall pay for such tests when unacceptable concrete is verified.

END OF SECTION 03 30 00

SECTION 03 54 00

CAST GYPSUM BASED UNDERLAYMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

1.02 REFERENCE STANDARDS

A. ASTM C1602/C1602M - Standard Specification for Mixing Water Used in the Production of Hydraulic Cement Concrete 2012.

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's data sheets documenting physical characteristics and product limitations of underlayment materials. Include information on surface preparation, environmental limitations, and installation instructions.

1.04 QUALITY ASSURANCE

A. Applicator Qualifications: Company specializing in performing the work of this section, and approved by manufacturer.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

B. Keep dry and protect from direct sun exposure, freezing, and ambient temperature greater than 105 degrees F.

1.06 FIELD CONDITIONS

A. Do not install underlayment until floor penetrations and peripheral work are complete.

B. Maintain minimum ambient temperatures of 50 degrees F 24 hours before, during and 72 hours after installation of underlayment.

C. During the curing process, ventilate spaces to remove excess moisture.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Gypsum Underlayment: Basis of design is USG Levelrock 2500 FR. Other acceptable manufacturers include:

1. ARDEX Engineered Cements; ARDEX K 22 F with ARDEX P51 Primer: www.ardexamericas.com/#sle.
2. Dependable Chemical Co., Inc: www.floorprep.com.
3. Hacker Industries, Inc: www.hackerindustries.com.
4. Maxxon Corporation; Commercial Topping: www.maxxon.com.
5. Substitutions: See Section 01 6000 - Product Requirements.

2.02 MATERIALS

A. Cast Underlayments, General:

1. Comply with applicable code for combustibility or flame spread requirements.
2. Provide certificate of compliance from authority having jurisdiction indicating approval of underlayment materials in the required fire

rated assembly.

B. Aggregate: Dry, well graded, washed silica aggregate, approximately 1/8 inch in size and acceptable to underlayment manufacturer.

C. Reinforcement: fibrous reinforcement complying with recommendations of underlayment manufacturer for specific project circumstances.

D. Water: ASTM C1602/C1602M; clean, potable, and not detrimental to underlayment mix materials.

E. Primer: Manufacturer's recommended type.

F. Joint and Crack Filler: Latex based filler, as recommended by manufacturer.

G. Sound Control Mat: Sheet material, perimeter isolation strip, and tape; as recommended by the underlayment manufacturer.

H. Sealer: Manufacurer's recommended type. Ensure compatibility with proposed finish floor materials.

I. Sound Deadening Pad: Acousti-Mat II “Green” as manufactured by Keene Quiet Qurl mat.

2.03 MIXING

A. Site mix materials in accordance with manufacturer's instructions.

B. Add aggregate for areas where thickness will exceed 1/2 inch. Mix underlayment and water for at least two minutes before adding aggregate, and continue mixing to assure that aggregate has been thoroughly coated.

C. Mix to self-leveling consistency without over-watering.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrate surfaces are clean, dry, unfrozen, do not contain petroleum byproducts, or other compounds detrimental to underlayment material bond to substrate.

3.02 PREPARATION

A. Wood: Install metal lath for reinforcement of underlayment.

B. Remove substrate surface irregularities. Fill voids and deck joints with filler. Finish smooth.

C. Vacuum clean surfaces.

D. Prime substrate in accordance with manufacturer's instructions. Allow to dry.

E. Close floor openings.

F. Install sound control mat in accordance with manufacturer's instructions.

3.03 APPLICATION

A. Install underlayment in strict accordance with manufacturer's instructions.

B. Pump or pour material onto substrate. Do not retemper or add water.
   1. Pump, move, and screed while the material is still highly flowable.
   2. Be careful not to create cold joints.
   3. Wear spiked shoes while working in the wet material to avoid leaving marks.

C. Place to indicated thickness, with top surface level to 1/8 inch in 10 ft.

3.04 CURING

A. Once underlayment starts to set, prohibit foot traffic until final set has been reached.

B. Air cure in accordance with manufacturer's instructions.

3.05 PREPARATION FOR INSTALLATION OF GLUE DOWN FLOOR GOODS

A. Sealing: Seal all areas that receive glue down floor goods with Maxxon Overspray 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. Levelrock 2500.

B. Floor Goods Procedures: See the Maxxon Corporation's "Procedures for Attaching Finished Floor Goods to Maxxon Underlayments" brochure for guidelines and requirements for installing finished floor goods. This procedure is not a warranty and is to be used as a guideline only. Levelrock 2500.

3.06 FIELD QUALITY CONTROL

A. Slump Test: Gyp-Crete 2000/3.2K “Green” mix shall be tested for slump as it's being pumped using a 2 inch by 4 inch (50 mm by 101 mm) cylinder resulting in a patty size of 8 inches (203 mm) plus or minus 1 inch (25 mm) diameter. Levelrock 2500.

B. Field Samples: At least one set of 3 molded cube samples shall be taken from each day's pour during the Gyp-Crete 2000/3.2K “Green” application. Cubes shall be tested as recommended by the Maxxon Corporation in accordance with modified ASTM C
472. Test results shall be available to architect and/or contractor upon request from applicator.

3.07 PROTECTION

A. Protect against direct sunlight, heat, and wind; prevent rapid drying to avoid shrinkage and cracking.

B. Do not permit traffic over unprotected floor underlayment surfaces.
   1. Protection From Heavy Loads: During construction, place temporary wood planking over Gyp-Crete wherever it will be subject to heavy wheeled or concentrated loads.

END OF SECTION

SECTION 04 00 00

MASONRY

PART 1 GENERAL

1.01 WORK INCLUDED

A. Provide the following:

1. Face brick.
2. Concrete masonry units.
   a. Standard
   b. Fire-rated
   c. Split face
   d. Scored
3. Glazed face concrete masonry units.
4. Acoustic concrete masonry units; standard and glazed face.
5. Ground face concrete masonry units; standard and acoustic.
6. Glazed structural facing tile.
7. Stone for lintels, sills and stools.
8. Masonry lintels and setting of steel angles furnished under Section 05 50 00.
9. Setting bearing plates supported and embedded with masonry furnished under Section 05 50 00.
10. Provide masonry fill concrete and reinforcing steel where indicated on drawings. See Section 03 30 00.
12. Wall reinforcing and accessories.
12. Built-in collars, sleeves, inserts, anchors, ties, sockets, bolts, blocking, miscellaneous metal work, etc., in contact with, supported on or enclosed by masonry. When these items are furnished by others, they shall include information for setting.
13. Through-wall flashing.
14. Includes grouting solid all hollow metal door frames in masonry.
15. Mortar and grout.
16. Concrete block vents.

1.02 RELATED SECTIONS

A. Sustainable Design Requirements: Section 01 81 13.

B. VOC Limits: Section 01 81 16.

C. Cast Stone: Section 04 72 00.

1.03 DEFINITIONS

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

1.04 SUBMITTALS

A. Product Data: For each different masonry unit, accessory and other manufactured products specified.

B. Shop Drawings: Show fabrication and installation details for the following:

1. Reinforcing Steel: Detail bending and placement of unit masonry reinforcing bars. Comply with ACI 315, “Details and Detailing of Concrete Reinforcement”. Show elevations of reinforced walls.
2. Fabricated Flashing: Detail corner units, end-dam units, and other special applications.

C. Samples: Provide samples of items specified herein to be used in the work.

D. Submit certification that fire resistant concrete units conform to the requirements specified herein for Fire Resistant Concrete Block.

E. Brick Cleaner

1. Applicator Qualifications: Submit qualifications of applicator.
   a. Certification stating applicator is experienced in the application of the specified products.

   b. List of recently completed masonry cleaning projects, including project name and location, names of owner and Architect, description of cleaning products used and substrates, applicable local environmental regulations, and application procedures.
2. Environmental Regulations: Submit description for testing, handling, treatment, containment, collection, transport, disposal, and discharge of hazardous wastes and cleaning effluents. Describe any hazardous materials to be cleaned from substrates. Submit applicable local environmental regulations.
3. Protection: Submit description for protecting surrounding areas, landscaping, building occupants, pedestrians, vehicles, and nonmasonry surfaces during the work from contact with masonry cleaners, stain removers, residues, rinse water, fumes, wastes, and cleaning effluents.
4. Surface Preparation: Submit description for surface preparation of substrates to be completed before application of masonry cleaners and stain removers.
5. Application: Submit description for application procedures of masonry cleaners.

F. Material Test Reports: From a qualified testing agency indicating and interpreting test results of the following for compliance with requirements indicated.

1. Each type of masonry unit required.
   a. Include size-variation data for brick, verifying that actual range of

sizes falls within specified tolerances.
b. Include test results, measurements, and calculations establishing net-area compressive strength of masonry units.
2. Mortar complying with property requirements of ASTM C270.
3. Grout mixes complying with compressive strength requirements of ASTM C476. Include description of type and proportions of grout ingredients.

G. Material Certificates: Signed by manufacturers certifying that each of the following items complies with requirements:

1. Each type of masonry unit required.
a. Include test data, measurements, and calculations establishing net-area compressive strength of masonry units.
2. Each combination of masonry unit type and mortar type. Include statement of net-area compressive strength of masonry units, mortar type, and net-area compressive strength of masonry determined according to Tables 1 and 2 in ACI 530.1/ASCE 6/TMS 602.
3. Each material and grade indicated for reinforcing bars.
4. Each type and size of joint reinforcement.
5. Each type and size of anchor, tie, and metal accessory.

H. Cold-Weather Procedures: Detailed description of methods, materials and equipment to be used to comply with cold-weather requirements.

I. Sustainable Design Documentation Submittals: Comply with Section 01 81 13.

1. VOC Limits: Include documentation verifying product Low Emitting Material Building Product Disclosures and Optimization.

1.05 QUALITY ASSURANCE

A. Supervisor: A supervisory journeyman mason shall be appointed for the project and shall be present at all times masonry work is being performed and:

1. have a minimum of 5 years experience on masonry projects of this type and size.
2. be thoroughly familiar with the design requirements, types of materials being installed, referenced standards and other requirements.

B. Use only skilled journeyman masons for cutting and placing of masonry; no allowance shall be made for lack of skill on the part of the workmen.

C. Consult other trades and make provisions that shall permit the installation of their work in a manner to avoid cutting and patching. Build-in work under other sections, as necessary, and as the work progresses.

D. Unit Masonry Standard: Comply with ACI 530.1/ASCE 6/TMS 602, 2013 Edition “Specifications for Masonry Structures”. Maintain one copy of the standard in project field office at all times during construction. Contractor’s supervisory

personnel shall be thoroughly familiar with the material as it applies to this Project.

1.06 DELIVERY, STORAGE AND HANDLING

A. Store cement and lime materials and masonry units off the ground, under cover and protected from weather damage. If units become wet, do not install until they are dry. Do not use cementitious materials that have become damp.

C. Stockpile and store aggregates to prevent contamination from foreign materials, in locations where grading and other required characteristics can be maintained.

D. Use care in handling units to avoid chipping and breakage.

E. Locate storage areas where they will not be disturbed or damaged by construction operations.

F. Protect finished floor areas from damage.

1.07 COLD WEATHER CONSTRUCTION

A. Comply with recommended practices for cold weather construction of the International Masonry Industry All-Weather Council and requirements contained in ACI 530.1/ASCE 6/TMS 602.

B. Do not build on frozen or snow covered work. Remove and replace masonry work damaged by frost or freezing.

C. Requirements During Construction: Provide the following minimum requirements for the air temperatures listed:

1. Above 40º F: Normal masonry procedures.
2. 40º F to 32º F: Heat mixing water to produce mortar temperatures between 40º F and 120º F. Produce consecutive batches of mortar with the same temperatures falling within this range. Do not heat mortar to greater than 120º F.

3. Below 32º F to 25º F: Heat sufficient mortar ingredients to produce mortar temperatures between 40º F and 120º F. Produce consecutive batches of mortar with the same temperatures falling within this range. Maintain mortar temperatures after mixing above 40º F. Do not heat mortar to greater than 120º F.
4. Below 25º F to 20º F: Heat sufficient mortar ingredients to produce mortar temperatures between 40º F and 120º F. Produce consecutive batches of mortar with the same temperatures falling within this range. Maintain mortar temperatures after mixing above 40º F. Do not heat mortar to greater than 120º F. Maintain masonry above freezing using auxiliary heat. Provide enclosure when wind is in excess of 15 mph.
5. Below 20º F: Heat sufficient mortar ingredients to produce mortar

temperatures between 40° F and 120° F. Produce consecutive batches of mortar with the same temperatures falling within this range. Maintain mortar temperatures after mixing above 40° F. Do not heat mortar to greater than 120° F. Maintain masonry above freezing using enclosure and auxiliary heat.

D. Protection Requirements for Completed Masonry (and masonry not being worked on): Provide the following minimum requirements for the mean daily air temperatures listed:

1. Above 40° F: Normal masonry procedures.
2. 40° F to 32° F: Protect from rain or snow for 24 hours with weather-resistive membrane.
3. Below 32° F to 20° F: Completely cover with weather-resistive membrane and maintain above freezing for 24 hours.
4. Below 20° F: Provide weather-resistant enclosure and auxiliary heat to maintain above freezing for 24 hours.

1.08 HOT WEATHER CONSTRUCTION

A. Protect masonry construction from direct exposure to wind and sun when erected in an ambient air temperature of 90° F., or greater in shade with relative humidity less than 50%. Provide artificial shade and wind breaks and use cooled materials as required. Provide artificial shade, wind breaks, use cooled materials and other procedures outlined in BIA Tech Notes #1.

1.09 PROJECT CONDITIONS

A. Do not apply uniform floor or roof loads for at least 12 hours and concentrated loads for at least 3 days after building masonry walls or columns.

1. Brace unsupported and newly laid masonry walls. Maintain bracing in place until building structure provides permanent bracing.

B. 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 become in contact with such masonry.

1. Protect base of walls from rain-splashed mud and from mortar splatter by coverings spread 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 on completed masonry.

PART 2 PRODUCTS

2.01 CLAY MASONRY UNITS

A. General: Provide materials that comply with Project Sustainable Design Requirements and Low Emitting Material goals.

B. Face Brick

1. Reference: Select exterior building brick conforming to ASTM C216, Grade SW.
2. Size: Standard.
3. Manufacturer/Color
   a. Field Brick: BELDEN BRICK Berwick Blend.
   b. Accent Brick: BELDEN BRICK Berwick Reds Range.
   c. Other Manufacturers: Brick by other manufacturers may be used providing the above requirements are met or exceeded. Color and texture must be equal as approved by the Architect prior to bid.]
4. Special Shapes: Provide solids, shelf angle bricks and other special shapes as indicated or required so as no brick cores are exposed to view. Color and texture to match face brick or accent brick as applicable.

D. Structural Glazed Facing Tile Units

1. Size: Manufacturer's standard unit.
2. Special Shapes
   a. Provide special corner, jamb, sash, control joints and other special conditions where shown and required.
   b. Provide bullnose edge tile for external corners, except where otherwise indicated.
   c. Provide coved base course.
3. General
   a. Comply with the following classifications, weights, grades, curing and other requirements as specified.
      1) ASTM C67.
      2) ASTM C126, Grade SS, Type I.
   b. For walls glazed both sides, provide two single glazed units.
   c. Provide manufacturer's standard factory finished ceramic glazed surface that is an integral part of clay unit.
   d. Color: Selected by Architect from manufacturer's full range of colors.
   e. Manufacturer: ELGIN-BUTLER BRICK COMPANY.

2.02 CONCRETE MASONRY UNITS

A. General

1. Curing: Cure for at least 7 days and units must be at least 28 days old when used in the work.
2. Corners (Interior Walls): Provide bullnose edges at all outside corners unless otherwise indicated or directed.
3. Colors

a. Concealed and Interior Exposure (not indicated to be colored): Natural color.
b. Exterior Exposed and Interior Exposed where indicated
1) Color 1: Light brown range as selected by Architect.
2) Color 2: Warmtone (tan) range as selected by Architect.

3. Colors
a. All Scored Units, All Split Face Units and Smooth Face Units (where indicated): Colors as follows:
1) Scored Smooth Face, except as specified below: WELLNITZ Carey Warmtone or similar color by OBERFIELD'S or other block manufacturer as approved by Architect prior to bid.
2) Scored Split Face Accent Bands and Smooth Face Base: WELLNITZ Charcoal or similar color by OBERFIELD'S or other block manufacturer as approved by Architect prior to bid.
3) Other Areas Not Identified: WELLNITZ Carey Warmtone or similar color by OBERFIELD'S or other block manufacturer as approved by Architect prior to bid.
b. All Other Units: Natural.

4. Integral Water Repellents: Use in units exposed to weather. Amount as recommended by water repellent manufacturer as approved by concrete block manufacturer.
a. Type: Liquid polymeric, integral water-repellent admixture that does not reduce flexural bond strength. Units made with integral water repellent, when tested according to ASTM E 514 as a wall assembly made with mortar containing integral water-repellent manufacturer's mortar additive, with test period extended to 24 hours, shall show no visible water or leaks on the back of test specimen.
b. Products/Manufacturers: Subject to compliance with requirements, provide W. R. GRACE Dry-Block; MASTER BUILDERS' INC. Rheomix-Rheopel; ACME-HARDESTY CO. Acme-Shield; KRETE INDUSTRIES KreteControl 202 Internal Water Repellent; EUCLID CHEMICAL Hydrapel System.

B. Hollow Load Bearing, Solid Load Bearing (75%) and Fire Resistant Concrete Masonry Units

1. Type: Hollow, load bearing, standard modular size and shapes, thoroughly cured and dried.
2. References: ASTM C90.
3. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 1900 psi.
4. Weight Classification: Normal weight, unless otherwise indicated.
5. Linear Shrinkage: Not to exceed 0.065 percent, ASTM C426.
6. Aggregate: ASTM C33 normal weight aggregates. Cinder aggregates not permitted.
7. Fire Resistant

a. Rating: Design for fire ratings indicated on drawings.
b. Manufacturer
   1) Listed in the Building Materials List published by the Underwriters' Laboratories, Inc.
   2) In lieu of above, provide a report from a nationally recognized testing agency stating that the units are equivalent in fire rating to those furnished by the producers as listed above.
c. Location: Where indicated.

C. Split Face Units

1. Type: Standard weight, hollow core, load bearing, modular units conforming to ASTM C90. Nominal [4 x 16] [8 x 16] face size. Thickness as indicated.
2. Provide all special shapes, including split faces, ends, and top surfaces as required to complete the work.

D. Glazed Masonry Units

1. Reference: ASTM C744
2. Type: Spectra Glaze II, satin finish, as manufactured by THE SPECTRA GROUP; Astra-Glaze by TRENWYTH INDUSTRIES.
3. Special Shapes
   a. Provide special corner, jamb, and other special conditions where shown and required.
   b. Provide coved base course where indicated.
   c. Scored Pattern: As indicated.
4. For walls glazed both sides, provide two single glazed units.
5. Colors: Selected by Architect from manufacturer's full range of colors. Three colors will be selected. Layout pattern as indicated.
6. Glazed Acoustic Concrete Masonry Units: See "Acoustic Concrete Masonry" herein.

E. Ground Face Concrete Units

1. Type: Ground face, hollow, load bearing, thoroughly cured and dried.
2. References of Block for Grinding: ASTM C90.
3. Manufacturer: [Trendstone Plus] [Verastone Plus], filled units by TRENWYTH INDUSTRIES; NEW HOLLAND CONCRETE, READING ROCK or PREMIER.
4. Surface: Fill ground surfaces with cementitious grout with minimum cured strength and durability equal to basic block unit. After polishing filled surfaces, field apply heat treated acrylic coating.
5. Colors: As selected by Architect. Two colors will be selected. Layout as indicated.
6. Special Shapes
   a. Provide special corner, jamb, and other special conditions where shown and required.

b. Provide coved base course where indicated.

F. Acoustic Concrete Units

1. Type: Hollow, load bearing, thoroughly cured and dried, and cast with normal weight aggregates. Provide with acoustic slots and insulation filler inserts.
   a. Filler inserts at glazed block to be moisture resistant insulation.
2. References: ASTM C90.
3. Color: Natural, except for glazed units.
4. Sizes: As indicated on drawings.
5. Manufacturer
   a. Basis of Design: Drawings and specifications are based on Soundblox units by THE PROUDFOOT COMPANY.
   b. Acceptable Manufacturers: Acousta-Wal units manufactured by TRENWYTH INDUSTRIES or equal are acceptable providing they meet or exceed the requirements specified.
6. Sound Absorption Coefficients: ASTM C423. (125/500/2000 Hertz)
   Type RSC - 12": 0.57 at 125 Hertz; 1.09 at 500 Hertz; 0.54 at 2000 Hertz.
   Type R - 4": 0.20 at 125 Hertz; 0.63 at 500 Hertz; 0.52 at 2000 Hertz.
7. Noise Reduction Coefficient: ASTM C423.
   Type RSC - 12": 0.85.
   Type R - 4": 0.65.

G. Precast Concrete Lintels

1. Mix: Minimum of 1 part cement to 3 parts aggregate.
2. Strength: Minimum compressive strength of 5000 psi at 28 days.
3. Finish: Thoroughly cured with exposed faces having a finish that approximates that of adjacent surfaces.
4. Provide for at least 8 in. bearing at each end unless otherwise indicated.
5. Color: Match adjacent concrete masonry.

H. Concrete Brick

1. Type: Solid, standard sizes and shapes, thoroughly cured and dried and cast with normal weight aggregates.
2. References: ASTM C55, Grade N.
3. Use as necessary to close openings in areas where concrete masonry is not exposed to view (i.e. close-off cavity of cavity walls at openings, work concealed behind drywall, etc.).

2.03 MISCELLANEOUS UNITS

A. Refractory Brick: Fireclay medium duty type in accordance with ASTM C27, Fireclay and High-Alumina Refractory Brick.

1. Provide in fireplace fire-box.

B. Flue Liner: Provide size and shape as indicated on drawings in conformance with ASTM C315, Clay Flue Linings.

2.04 MORTAR

A. Materials

1. Portland Cement: ASTM C150, 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 or selected.
2. Masonry Cement: ASTM C91, provide non-staining type for stonework.
3. Hydrated Lime: ASTM C207, Type S.
4. Aggregate: ASTM C144, clean masonry sand, not over 10% to pass No. 100 sieve for general use.
5. Water: Clean, fresh and free of deleterious amounts of acids, alkalis and foreign organic matter.
6. Water Repellent Admixture: W. R. GRACE Dry-Block, RHEOMIX - Rheopel Mortar Admixture; MASTER BUILDERS, INC., KRETE INDUSTRIES KreteGuard 390. Manufacturer must submit certification that water repellent admixture meets or exceeds requirements specified herein.
   a. Conformance: ASTM E514.
   b. Type: Integral polymeric water-repellents (IPWR).
7. Color Additive: Inorganic pigments as required to produce colored mortar as selected by Architect. SGS Colors by SOLOMON GRIND CHEM SERVICE; DAVIS COLORS or equal.
   a. Resistant to alkali, light and weather
   b. Unaffected by cement and free of water soluble salts.
8. Cold Weather Additive: Non-chloride, non-corrosive, accelerating admixture complying with ASTM C494, Type C or ASTM C1384 and recommended by the manufacturer for use in masonry mortar of composition indicated.

B. Proprietary Mortar Cement: Conform to ASTM C91, containing hydrated lime.

1. Certification: Submit certified laboratory data substantiating conformance with structural requirements for mortars as specified; and that no adverse chemical reaction will occur with the specified masonry accessories and reinforcing. Certification must be received and approved by Architect prior to mortar use.
2. Suitable products are acceptable from the following manufacturers:
   a. MIAMI
   b. LEHIGH HANSON
   c. ESSROC MATERIALS, INC. (Brixment)
   d. QUIKRETE
   e. CEMEX INC.

C. Mixes - Unit Masonry

1. Provide water repellent admixture in all mortar used for exterior CMU masonry work. Add to mix in accordance with manufacturer's recommendations.
2. Type M Mortar
   a. Use: Provide for CMU work below grade or in contact with earth.
   b. Proportions: ASTM C270 proportions by volume. Minimum average compressive strength at 28 days of 2,500 psi.
   c. Color: Natural color.
3. Type S Mortar
   a. Use: Provide for all CMU work.
   b. Proportions: ASTM C270 proportions by volume. Minimum average compressive strength at 28 days of 1,800 psi.
   c. Colors
      1) Concealed work and natural colored concrete masonry units: Natural color.
      2) Colored concrete masonry units: As selected by Architect.
4. Type N Mortar
   a. Use: Provide for brick veneer and cast stone.
   b. Proportions: ASTM C270 proportions by volume. Minimum average compressive strength at 28 days of 750 psi.
   c. Colors: As selected by Architect.

D. Mix - Cut Stone: One part non-staining masonry cement, one part hydrated lime, and six parts damp, loose sand.

E. Cast Stone Pointing Mortar: One part non-staining masonry cement, one part hydrated lime, and four parts damp, loose sand. Add coloring pigment as required to match mortar color selected by Architect.

F. Grout - For Pointing Glazed Block Joints: Dry-set grout composed of Portland Cement and additives formulated for ceramic tile and glazed block. ANSI 118.7 with grout sealer per Section 09 30 00.

1. Colors: Selected by Architect from manufacturer's colors.
2. Manufacturer:
   a. MAPEI.
   b. CUSTOM BUILDING PRODUCTS.
   c. LATICRETE

2.05 GROUT

A. Masonry Grout - Mix

1. Fine Grout for Reinforced Masonry: Mix with mechanical mixer with sufficient water to the desired consistency in accordance with ASTM C476 Proportion Specifications.
   a. Portland Cement: 1 part

b. Hydrated Lime: 0 to 1/10 part
c. Fine Aggregate: 2-1/4 to 3 times the sum of the volumes of the cementitious materials

2. Coarse Grout for Reinforced Masonry: Mix with mechanical mixer with sufficient water to the desired consistency in accordance with ASTM C476 Proportion Specifications.
   a. Portland Cement: 1 part
   b. Hydrated Lime: 0 to 1/10 part
   c. Fine Aggregate: 2-1/4 to 3 times the sum of the volumes of the cementitious materials.
   d. Coarse Aggregate: 1 to 2 times the sum of the volumes of the cementitious materials.
3. Hand Mixing: Not acceptable.

2.06 REINFORCING

A. Manufacturers: DUR-O-WALL; HECKMANN BUILDING PRODUCTS; HOHMANN & BARNARD; MASONRY REINFORCING CORPORATION OF AMERICA (WIREBOND). Where products are specified referencing a particular manufacturer, equal products from the manufacturers listed are acceptable providing the product meets the requirements indicated.

1. Where a manufacturer is listed below for a specific product, it is to establish a level of quality. Similar products of equal quality from the above listed manufacturers are acceptable.

B. Horizontal Joint Reinforcement

1. General
   a. Type: Ladder type, standard weight, galvanized.
   b. Width: Approximately 2 in. less than nominal wall thickness.
   c. Spacing: Continuous along horizontal joint, spaced 16 inches on center vertically, unless otherwise indicated.
2. Longitudinal Wire
   a. Single Wythe Walls: 2 wires.
   b. Multi-wythe Walls:
      1) Each wythe less than 6 inches wide: 1 wire.
      2) Each wythe 6 inches and wider: 2 wires.

C. Metal "Z" Ties: 3/16" galvanized steel "Z" shaped wire ties, 2" narrower than wall width. For use in block wythes at control joints.

D. Adjustable Veneer Anchor

1. Steel Stud or Structural Steel Back-Up: Two piece, adjustable loop type anchor and tie. Anchors and ties shall be carbon steel, devices, hot dip galvanized after fabrication, coating conforming to ASTM A153, Class B2, 1.5 ounce coating per square foot. Manufacturer to provide oversized hole as required to accommodate diameter of screws without abrasion of zinc

coating.

a. Anchor: Provide anchors that allow vertical adjustment but resist a 100-lbf load in both tension and compression perpendicular to plane of wall without deforming or developing play in excess of 1/16 inch.
   1) Steel Stud Back-Up: Screw-on galvanized steel strap anchor, 12 gage by 3/4" wide by 9" long with 3/8" offset and 4" adjustment. Provide strap with 3/8" hole at each end for fasteners. Provide self-tapping carbon steel screws with minimum 0.0005" of zinc coating. HECKMANN 315-C.
   2) Steel Stud/ Sheathing Back-Up: Screw-on galvanized steel strap anchor with stand-off legs for insulation sheathing board in depths required. X-SEAL by HOHMANN & BARNARD or similar type design manufactured by HECKMANN, AA WIRE PRODUCTS, DUR-O-WAL, INC., NATIONAL WIRE PRODUCTS INDUSTRIES. Seal insulation face with reinforced polyolefin base, laminated to a polypropylene layer tape. Alternate design attachment must be specifically designed for insulated sheathing in depths required.
   3) Structural Steel Back-Up: Weld-on steel strap anchors. Field prime after welding. 12 gage by 1/2" wide by 8' long with six 3/8" offsets to provide 7-3/4" vertical adjustment. HECKMANN 317-B.
   4) Fasteners: Hot-dipped galvanized steel bolt, nut and washer.
   5) Depth: Provide engineered analysis of anchors over 4 ½”.
b. Ties: Triangular tie, fabricated from 3/16" diameter galvanized cold drawn steel wire. Provide ties long enough to engage the anchor and be embedded not less than 2" into the bed joint of the masonry veneer. HECKMANN 316 Series.

2. Wood Stud Back-Up: Screw on anchor plate fabricated 14 gage hot dipped galvanized steel. 1 ¼” x 6” long. 315D from by HECKMANN or similar products.
   a. Ties: Triangular tie, fabricated from 3/16" diameter galvanized cold drawn steel wire. Provide ties long enough to engage the anchor and be embedded not less than 2" into the bed joint of the masonry veneer. HECKMANN 316 Series.

E. Wire Mesh: Wire Mesh: 1/4" mesh of galvanized steel wire (min. 16 gage) or galvanized metal lath, cut into strips 1-1/2" narrower than wall width where used. For use at intersection of masonry walls.

F. Dovetail Anchors

1. Anchor Slots: 1 in. wide, 1 in. deep, 5/8 in. throat, 24 ga. galvanized steel. HECKMAN No. 100, HOHMANN & BARNARD, or equal.
2. Anchors: Brick, minimum 1 in. wide by 3-1/2 in long, flat or corrugated. HECKMAN No. 103 or 104; HOHMANN & BARNARD, or equal.

G. Reinforcing Steel - Bond Beam and Wall Reinforcement: Uncoated steel reinforcing bars; ASTM A615/A; ASTM A616, including Supplement 1; or ASTM A617/A, Grade 60.

H. Partition Top Anchors: 12 gage galvanized steel plate with 7/16-inch diameter holes. HOHMANN & BARNARD PTA 422 or equal.

2.07 MISCELLANEOUS ITEMS

A. Through-Wall Flashing:

1. Elastomeric Thermoplastic Flashing: Composite flashing product consisting of a polyester-reinforced ethylene interpolymer alloy. Tensile Strength - ASTM D412C 14%, Puncture Resistance - ASTM E154 300 lbs. minimum
   a. Self-Adhesive Sheet: Elastomeric thermoplastic flashing, 40 mil thick with thick coating of adhesive.
   b. Manufacturer: DUPONT; HOHMANN & BARNARD, INC; MORTAR NET SOLUTIONS; WIRE-BOND.
2. Stainless Steel Core Flexible Flashing with Drainage Fabric (SSCFF).
   a. Material: Composite with stainless steel with adhesive polymer fabric laminated to one stainless steel and non-woven drainage fabric laminated to opposing face with adhesive.
      1) Stainless steel: type 304, ASTM A240
      2) Polymer fabric; laminated back face to stainless steel core.
      3) Non-woven drainage fabric: Fabric laminated to front face stainless steel core.
   b. Manufacturer: YORK MANUFACTURING, INC.; York Flash-Vent SS, STS COATINGS, INC.; Wall Guardian Venting Stainless Steel TWF, BUILDING MATERIALS WEST COMPANY, INC.; Evacu-Flash SS
   c. Note: Eliminate cavity protection material if SSCFF used.
   d. Note: Eliminate drip edge by terminating at brick face and sealing down the flashing if SSCFF used. However, provide drip edges above windows and doors for replacement ease.

B. Sheet Metal Drip Edge: Fabricated from 0.015” thick by minimum 3” wide stainless steel with hemmed edge. Comply with requirements specified in Section 07 62 00 - Flashing and Sheet Metal.

1. Product: HECKMAN BUILDING PRODUCTS, IPCO stainless steel drip edge, ILLINOIS PRODUCTS CORPORATION or HOHMANN & BARNARD, INC.

C. Preformed Masonry Control Joint Filler

1. General: Extruded rubber complying with ASTM D2240, general purpose

grade.

2. Flange: Where applicable, locate as required for the particular joint configuration.
3. Manufacturer: Rapid Regular Control Joint by DUR-O-WALL; HOHMANN & BARNARD, or equal.

D. Block Core Insulation - Contractor's Option: Exterior concrete masonry walls and concrete masonry party walls: Contractor may use one of the insulation types as specified below. The same type must be used throughout the entire project. Provide one of the following insulation options:

1. Foam-In-Place Insulation: See Section 07 21 00.
2. Insulating Block Units: Insul Bloc by INSUL BLOCK CORP. (with integral insulating units) using lightweight aggregate for masonry block units.
3. Block Core Inserts: Provide insulation inserts installed in block plant prior to shipment to job site.
   a. Material: Expanded polystyrene designed to fit proposed masonry units. Conform to ASTM C578 Insulation Board-Thermal Type I and Type II.
   b. Thickness and R-Value: 2" thick, minimum 7.8 R-value.
   c. Manufacturer: Blocfil by MILLER MATERIAL CO.; KORFIL INC.; W.R. GRACE.

E. Brick Cleaning Compound: PROSOCO Sure Klean 600 Detergent; or equal commercial cleaning solution by NATIONAL CHEMSEARCH or AMERICAN CALMAL that will not harm masonry or adjacent materials and is acceptable to the masonry manufacturer. Cleaners containing muriatic acid are not acceptable.

F. Cell Vent: Polypropylene Model #QV Quadro Vent by HOHMANN & BARNARD; Model D/A 1006 by DUR-O-WALL or equal by HECKMANN. Color as selected by Architect.

G. Isolation Liners: Locate between steel columns and masonry. Asphalt impregnated cellular paper, similar to WILLIAMS PRODUCTS Columns Boxboard, 1/4" single thickness or 1/2" double thickness. Use double thickness except where wall dimensions do not permit, then use single thickness.

H. Cavity Protection Material: Minimum 1" thick, reticulated, nonabsorbent mesh, made from polyethylene strands and shaped to maintain drainage at weep holes without being clogged by mortar droppings.

1. Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
   a. Mortar Net; MORTAR NET USA, LTD.
   b. Mortar Break; ADVANCE BUILDING PRODUCTS
   c. Mortar Net; MASONRY REINFORCING CORPORATION OF AMERICA.
   d. Mortar Net; HOHMANN & BARNARD, INC.
   e. CavClear Masonry Mat; ARCHOVATIONS
   f. Mortar Stop; POLYTITE MANUFACTURING CORP.

g. Mortar Grab: IPCO PRODUCTS.

I. Concrete Block Vents: Extruded aluminum; nominal 8” high x 16” long x 4” deep; clear aluminum finish. SUNVENT INDUSTRIES Model EX or equal by AIROLITE or INDUSTRIAL LOUVERS, INC.

PART 3 EXECUTION

3.01 INSPECTION

A. Examine the substrates, structure, and installation conditions. Do not proceed with unit masonry work until unsatisfactory conditions are corrected.

3.02 PREPARATION

A. Brick

1. Wet brick having ASTM C67 absorption rates greater than 0.025 oz. per square inch per minute. Use wetting methods which ensure that each masonry unit is nearly saturated, but surface dry when laid. During freezing weather, comply with the recommendations of BIA.
2. Except for absorbent units specified to be wetted, lay masonry units dry.

B. Concrete Masonry Units: Lay masonry units dry. Do not wet concrete masonry units.

C. Establish lines, levels, and coursing.

D. Coordination: Identify items that are to be built-in to masonry wall as specified in other section of these specifications. Verify that these items are available prior to commencing masonry work in these areas. Coordinate sizes of required openings. Items include, but are not necessarily limited too:

1. Access doors
2. Recessed fire extinguisher cabinets
3. Recessed toilet accessories

3.03 INSTALLATION - GENERAL

A. Build walls to the full thickness shown. Build single wythe walls to the actual thickness of the masonry units, using units of nominal thickness shown or specified.

B. Cut masonry units using motor-driven masonry saws to provide clean, sharp, unchipped edges. Cut units as required to provide pattern shown and to fit adjoining work neatly. Use full-size units without cutting wherever possible. Provide 100% solid units where webs would be exposed.

C. Construction Tolerance: Comply with tolerances in ACI 530.1/ASCE 6/TMS 602

and the following:

1. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than ¼" in 20 feet, nor ½" maximum.
2. For vertical alignment of exposed head joints, do not vary from plumb by more than ¼" in 10 feet, nor ½" maximum.
3. For conspicuous horizontal lines, such as exposed lintels, sills, parapets, and reveals, do not vary from level by more than ¼" in 20 feet, nor ½" maximum.
4. For exposed bed joints, do not vary from thickness indicated by more than plus or minus 1/8", with a maximum thickness limited to ½". Do not vary from bed-joint thickness of adjacent courses by more than 1/8".
5. For exposed head joints, do not vary from thickness by more than plus or minus 1/8". Do not vary from adjacent bed-joint and head-joint thicknesses by more than 1/8".

D. Openings: Form all chases and openings required for piping and other trades. After work is completed, close openings with masonry and seal around penetration.

E. Seal all anchor penetrations and tears in the vapor barrier as a result of the work installed under this section.

3.04 ERECTION - BRICK AND CONCRETE MASONRY

A. Masonry

1. Layout walls in advance for accurate spacing of surface bond patterns, with uniform joint widths, and to properly locate returns and offsets. Avoid the use of less than half-size units at corners, jambs and other locations.
2. Lay up walls plumb and true to comply with specified tolerance. Provide courses level, accurately spaced and coordinated with other work.
3. Pattern Bond: Lay exposed masonry in running bond with vertical joint in each course centered on units in courses above and below. Bond and interlock each course of each wythe at corners. Do not use units with less than 4" of horizontal face dimensions at corners.
4. Lay hollow concrete masonry units with full mortar coverage on horizontal and vertical face shells. Bed webs in mortar in starting course on footings and slabs. Maintain 3/8" joint widths, except for minor variations required to maintain bond alignment.
5. Joints
   a. Exposed: Cut flush and finish (tool) with hardened metal tool to form a concave compressed joint. Same methods and types of tools to be used by all masons working on project.
   b. Concealed: Cut flush and trowel point.
6. Compress and cut joints flush for masonry foundation walls.
7. Lay brick masonry units with completely filled bed and head joints. Butter ends with sufficient mortar to fill head joints and shove into place. Do not

slush head joints.

B. Horizontal Wall Reinforcement: Provide continuous masonry joint reinforcement as indicated. 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.
3. Provide reinforcement not more than 8 inches above and below wall openings and extending 12 inches beyond openings.
   a. Reinforcement above is in addition to continuous reinforcement.
4. Cut or interrupt joint reinforcement at control and expansion joints, unless otherwise indicated.
5. Provide continuity at corners and wall intersections by using prefabricated "L" and "T" sections. Cut and bend reinforcing units as directed by manufacturer for continuity at returns, offsets, column fireproofing, pipe enclosures, and other special conditions.
6. Provide additional reinforcement continuous in first joint above openings and in first joint below openings not extending to floor. Extend additional reinforcement a minimum of 4'-0" beyond opening.

C. Brick Veneer/Metal Stud Wall Ties: Install in accordance with manufacturer's instructions. Locate one tie per every two square feet of wall surface and in accordance to BIA Technical Notes No. 44B.

D. Veneer/Cavity Wall Construction

1. Keep the air space clear and clean of all mortar droppings and other debris.
2. Provide weeps spaced 24 inches apart. 3. Make weep holes by methods subject to Architect's approval
   a. Gray Mortar: Louvered PVC weep, similar to HOHMANN & BARNARD #343 located in brick head joints.
   b Colored Mortar: Cellular weep vents located in brick head joints.
   c. Tube and Cotton Wick: Medium Density Polyethylene
4. Provide top of wall weep ventilation with cellular vent at 24 inches apart.

E. Door Frames: Fill all frames installed in masonry with mortar.

F. Bearing Points: Where a lintel, bar joist or similar member bears directly on concrete masonry, fill the cores of the two blocks courses directly under the member with grout to a limit of 16 inches beyond the end of the member.

G. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath in the joint below and rod mortar or grout into core.

H. Control and Expansion Joints: Provide control joints for exterior and interior masonry construction in accordance with NCMA-TEK Bulletins 10-1A and 10-2B

and BIA Technical Notes 18A. Verify control

1. Unless otherwise indicated, provide control joints in masonry walls at maximum 24 foot intervals for exterior walls, maximum 30 foot intervals for interior walls, and at intersections of walls, except corners.
   a. Exact locations as determined by the Architect if not specifically dimensioned. Verify locations do not conflict with structural shear wall requirements.
   b. If drawings do not indicate all control joints based on these maximums, allow for additional joints to be determined by the Architect prior to commencement of masonry work.
   c. Locate control at steel columns.
2. Provide 3/8" wide control joints, unless otherwise indicated. For joints in exterior walls, build in control joint filler strips as masonry wall is laid up allowing 3/4" for sealant and backup on each side of wall. For interior control joints, no filler is required; rake joint approximately 3/4" deep and install sealant and backup. See Section 07 92 00, Sealants.
3. Do not carry horizontal joint reinforcement through control joint.
4. Maintain lateral support of continuous wall at control joint in concrete block backup walls by using control joint filler, tongue and groove type control joint block, or similar type approved method. In cavity walls, place metal “Z” wall ties 16" on-center vertically in brick on each side of control joint.
5. Maintain lateral support of intersecting interior masonry walls with wire mesh ties placed across joint between walls, spaced 16" on-center vertically.

I. Thru-Wall Flashing

1. Provide at the following locations:
   a. In first course above steel supports and shelf angles.
   b. In first course above lintels at louvers, windows and doors.
   c. In first course above grade around entire building perimeter.
   d. In exterior walls that project above adjacent lower roof.
   e. Below sills of window, louver and similar type wall openings.
   f. Below parapet wall caps.
   g. Other through wall flashing conditions where indicated.
2. Ensure that flashings drain to exterior.
3. Prepare masonry surfaces smooth and free of projections which could puncture flashing.
4. Lay on slurry of fresh mortar and cover with mortar.
5. End Dams: Provide end dams at all locations where flashing terminates within a wall. Over openings, carry minimum 6" beyond end of steel lintel and turn up edges to form pan. All corners folded, not cut.
6. Install metal drip edges beneath flexible flashing at exterior face of wall. Stop flexible flashing 1/2 inch back from outside face of wall and adhere flexible flashing to top of metal drip edge.
7. Top Edge Concealed Terminations: 8 inch minimum above drainage plane.
8. Seal around all penetrations with mastic before covering with mortar.
9. Joints

a. Install in longest lengths and with fewest joints possible but not less than 20 feet between joints.
b. Lap ends minimum 6 inches and seal with full bed of mastic.

10. Continue flashings around corners and other gaps in shelf angles to prevent discontinuity.
11. Continue flashing through expansion joints.
12. Provide weeps at all thru-wall flashing locations. Space weeps as specified hereinbefore.

J. Place cavity drainage material in cavities to comply with configuration requirements for cavity drainage material specified herein.

K. Masonry, non-bearing walls carried to structure above: Terminate at normal joint width below surface and leave joint open for sealants.

1. At fire-rated partitions, install firestopping in joint between top of partition and underside of structure above to comply with Section 07 84 00, Firestopping.

L. Stopping and Resuming Work: In each course, rack back one-half-unit length for one-half running bond or one-third-unit length for one-third running bond; do not tooth. Clean exposed surfaces of set masonry, wet clay masonry units lightly if required, and remove loose masonry units and mortar before laying fresh masonry.

M. Built-in Work: As construction progresses, build in items specified under this and other Sections of the Specifications. Fill in solidly with masonry around built-in items.

N. Steel Lintels: Install steel lintels at all masonry opening, whether indicated on the drawings or not. Provide minimum bearing of 8” an each jamb, unless otherwise indicated.

O. Insulation Fill

1. Place where indicated on the Drawings.
2. Pour directly into the wall from the bag or from a hopper.
3. Pours may be made at any convenient interval; however, extreme care shall be exercised to be sure that all cores are full of insulation.
4. Place temporary signs on walls and warn other trades to use caution in cutting into wall to avoid loss of insulation.

3.05 MORTAR

A. General

1. Batch Size: Controlled so that all material used within two (2) hours.
2. Mortar on Board
a. Keep well tempered with water so long as its cementing material

has not started to set.

b. Do not retemper if initial set of cementing material has been reached, or if mortar has stiffened greatly.

3. Anti-freeze Admixture: Not permitted.
4. Water Repellent Admixture: Use with brick and concrete block exposed to exterior, mix as recommended by manufacturer.

B. Mixing

1. Machine mix dry in a batch mixer with care taken in adding water to mix to avoid overwetting.
2. Do not retamper in mixer at any time.
3. Continue mixing for a minimum of five (5) minutes after all materials are in mixer.

C. Recharging: Completely empty and clean mixer before recharging.

3.06 PROTECTION

A. Brace all walls while in green condition.

B. 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 and hold cover securely in place.
2. Where one wythe of multiwythe masonry walls is completed in advance of other wythes, secure cover a minimum of 24 inches down face next to unconstructed wythe and hold cover in place.

3.07 REINFORCED MASONRY INSTALLATION

A. Placing Reinforcement: Comply with requirements of ACI 530.1/ASCE 6/TMS 602.

1. General: Clean reinforcement of loose rust, mill scale, earth, ice or other materials which will reduce bond to mortar or grout. Do not use reinforcement bars with kinks or bends not shown on drawings or final shop drawings, or bars with reduced cross-section due to excessive rusting or other causes.

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

1. Comply with requirements of ACI 530.1/ASCE 6/TMS 602 for cleanouts and for grout placement, including minimum grout space and maximum pour height.
2. Use "Fine Grout" per ASTM C 476 for filling spaces less than 4" in one or

both horizontal directions.

3. Use "Coarse Grout" per ASTM C 476 for filling spaces 4" to 10" in both horizontal directions.
4. Use 3000 psi concrete for filling spaces 10" or larger in both horizontal directions.

C. Bond Beams: Reinforce as indicated and fill with grout. Position reinforcement accurately at the spacing indicated. Place horizontal reinforcement as the masonry work progresses.

D. Reinforced Concrete Masonry Walls: Install and align grout block units to provide continuous vertical voids in walls. Install reinforcing steel as work progresses. Use horizontal bars to position vertical bars. Fill grout block units cores solid with concrete fill.

1. Place concrete fill in maximum 4’-0” vertical lifts. Recess top of fill minimum 1-1/2” below top of course to form a key with the following lift. Comply with NCMA TEK Bulletins 3-2, 3-3A and 14-2 recommendations.
2. Coordinate placement of reinforcement and concrete fill with cast-in-place concrete and precast concrete work to provide continuous vertical and horizontal reinforcement full height of indicated walls.

3.09 FIELD QUALITY CONTROL

A. Contractor will engage a qualified independent testing agency to perform source quality-control testing indicated below:

1. Retesting of materials failing to meet specified requirements shall be done at Contractor’s expense.

B. Testing Frequency: Tests and Evaluations listed in this Article will be performed during construction for each 5000 sq. ft. of wall area or portion thereof.

C. Mortar Aggregate Ratio Test (Proportion Specification): For each mix provided, according to ASTM C780.

D. Grout will be sampled and tested for compressive strength per ASTM C1019.

E. Brick Tests: For each type and grade of brick indicated, units will be tested according to ASTM C67.

F. Concrete Masonry Unit Tests: For each type of concrete masonry unit indicated, units will be tested according to ASTM C140.

G. Prism-Test Method: For each type of wall construction indicated, masonry prisms will be tested per ASTM C1314, and as follows:

1. Prepare 1 set of prisms for testing at 7 days and 1 set for testing at 28 days.

3.10 REPAIR, POINTING AND CLEANING

A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged. Provide new units to match adjoining units and install in fresh mortar pointed to eliminate evidence of replacement.

B. During the tooling of joints, enlarge all voids or holes, and completely fill with mortar. Point up all joints at corners to provide a neat, uniform appearance.

C. Cleaning - Brick Masonry: Clean all exposed brick masonry. Cleaning agents and methods subject to Architect's approval. Protect all stone. Damaged materials and work replaced at Contractor's expense.

1. Before full-scale application, review manufacturer's product data sheets to determine the suitability of each product for the specific surfaces. Apply each masonry cleaner to test panel areas to determine dilution rates, dwell times, number of applications, compatibility, effectiveness, application procedures, effects of pressure rinsing, and desired results.
2. Apply masonry cleaners and stain removers to test panels in accordance with manufacturer's written instructions. Allow 48 hours or until test panels are thoroughly dry before evaluating final appearance and results. Do not begin full-scale application until test panels are inspected and approved by the Architect.
3. Test Area Requirements:
    a. Size: Minimum 5 feet by 4 feet each.
    b. Locations: As determined by the Architect.
    c. Masonry Cleaners: Number of test panels as required to completely test each masonry cleaner with each type of substrate to be cleaned.
4. Test all cleaning effluents generated by the masonry cleaning of the test panels to determine any hazardous characteristics. Comply with applicable federal, state, and local environmental regulations including testing, handling, treatment, containment, collection, transport, disposal, and discharge of hazardous wastes.
5. Muratic acid cleaning of brick masonry not permitted. Install and protect installed brick masonry so that acid cleaning is not required at completion of the work.

D. Cleaning – Concrete Masonry: During construction of exposed CMU, minimize mortar and grout smears on exposed surfaces. Dry brush CMU surfaces at the end of each days work and after final pointing. Remove mortar stains and dirt from exposed surfaces.

1. Cleaning Solutions: Where cleaning solutions are required, they shall be provided at no additional cost to the Owner. Cleaning solutions must be approved by Architect and spot tested prior to use.

E. Area Cleaning: Clean floors of all mortar droppings, including floor surfaces of

accessible chases.

3.11 MASONRY WASTE DISPOSAL

A. Unless otherwise indicated, excess masonry materials are Contractor's property. At completion of unit masonry work, remove from Project site.

B. Disposal as Fill Material: When approved by Geotechnical Engineer, dispose of clean masonry waste, including broken masonry units, waste 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 each dimension.
2. Mix masonry waste with at least two parts of specified fill material for each part of masonry waste. Fill material is specified in Section 31 30 00, Earthwork. All fill material must be approved by Geotechnical Engineer.
3. 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 masonry waste, and legally dispose of off Owner's property.

3.12 REPOINTING EXISTING WALLS

A. Remove mortar to a depth of at least 1/2" with hand or power tool.

B. When cutting is complete, remove all loose material with a brush or hose stream.

C. Point joints with prehydrated Type N mortar consisting of 1 part Portland cement, 1 part Type S hydrated lime, 6 parts sand.

D. Wet raked mortar joints thoroughly before applying fresh mortar. Allow water to soak into wall so no free-standing water is visible.

E. Pack mortar tightly in thin layers until joint is filled, then tool to a smooth concave surface.

END OF SECTION

SECTION 04 72 00

CAST STONE MASONRY

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Architectural cast stone.

B. Units required are:

1. Exterior wall units, including wall caps, coping, and sills.

1.02 REFERENCE STANDARDS

A. ACI 318 - Building Code Requirements for Structural Concrete and Commentary 2014 (Errata 2018).

B. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement 2020.

C. ASTM A767/A767M - Standard Specification for Zinc-Coated (Galvanized) Steel Bars for Concrete Reinforcement 2016.

D. ASTM A884/A884M - Standard Specification for Epoxy-Coated Steel Wire and Welded Wire Reinforcement 2014.

E. ASTM A1064/A1064M - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete 2018a.

F. ASTM C33/C33M - Standard Specification for Concrete Aggregates 2018.

G. ASTM C150/C150M - Standard Specification for Portland Cement 2020.

H. ASTM C270 - Standard Specification for Mortar for Unit Masonry 2019.

I. ASTM C494/C494M - Standard Specification for Chemical Admixtures for Concrete 2019.

J. ASTM C1364 - Standard Specification for Architectural Cast Stone 2019.

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Manufacturer's Qualification Data: Documentation showing compliance with specified requirements.

C. Product Data: Test results of cast stone components made previously by the manufacturer.

1. Include one copy of ASTM C1364 for Architect's use.

D. Shop Drawings: Include elevations, dimensions, layouts, profiles, cross sections, reinforcement, exposed faces, arrangement of joints, anchoring methods, anchors, and piece numbers.

E. Where proposed design or spans mandate, stone assemblies shall be subject to the delegated design of the stone supplier ensuring adequate structural and performance characteristics complying with design conditions and all applicable codes.

F. Mortar Color Selection Samples.

G. Verification Samples: Pieces of actual cast stone components not less than 6 inches square, illustrating range of color and texture to be anticipated in

components furnished for the project.

1.04 QUALITY ASSURANCE

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver cast stone components secured to shipping pallets and protected from damage and discoloration. Protect corners from damage.

B. Number each piece individually to match shop drawings and schedule.

C. Store cast stone components and installation materials in accordance with manufacturer's instructions.

D. Store cast stone components on pallets with nonstaining, waterproof covers. Ventilate under covers to prevent condensation. Prevent contact with dirt.

E. Protect cast stone components during handling and installation to prevent chipping, cracking, or other damage.

F. Store mortar materials where contamination can be avoided.

G. Schedule and coordinate production and delivery of cast stone components with unit masonry work to optimize on-site inventory and to avoid delaying the work.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide Weather Ledge by Dutch Quality Stone or comparable product by one of the following:
1. Shouldice Designer Stone
2. Centurion
3. Daltile
4. Northfield Block Company
5. Owens Corning
6. Quality Stone Veneer
7. RiverValley

2.02 ARCHITECTURAL CAST STONE

A. Performance Requirements:
1. Compressive Strength - ASTM C 1194: 6,500 psi minimum for products at 28 days.
2. Absorption - ASTM C 1195: 6% maximum by the cold water method.
3. Air Content – ASTM C 173 or C 231, for wet cast product shall be 4-8% for units exposed to freeze-thaw environments. Air entrainment is not required for VDT products.
4. Freeze-thaw – ASTM C 1364: The CPWL shall be less than 5% after 300 cycles of freezing and thawing.
5. Linear Shrinkage – ASTM C 426: Shrinkage shall not exceed 0.065%.
6. Bond Between Manufactured Masonry Unit, Mortar and Backing: Not less than 50 psi (345 kPa) when tested in accordance with ASTM C482 using Type S mortar.
7. Freeze/Thaw: No disintegration and less than 3% weight loss when tested in accordance with ASTM C67.
8. Surface Burning Characteristics: Not more than the following when tested in accordance with UL 723:
a. Flamespread: 25.
b. Smoke Development: 450.

B. Shapes: Provide shapes indicated on drawings.
   1. Variation from Any Dimension, Including Bow, Camber, and Twist: Maximum of plus/minus 1/8 inch or length divided by 360, whichever is greater, but not more than 1/4 inch.
   2. Unless otherwise indicated on drawings, provide:
      a. Wash or slope of 1:12 on exterior horizontal surfaces.
      b. Drips on projecting components, wherever possible.
      c. Raised fillets at back of sills and at ends to be built in.

C. Reinforcement: Provide reinforcement as required to withstand handling and structural stresses; comply with ACI 318.

2.03 MATERIALS

A. Portland Cement: ASTM C150/C150M.
   1. For Mortar: Type I or II, except Type III may be used in cold weather.

B. Coarse Aggregate: ASTM C33/C33M, except for gradation; granite, quartz, or limestone.

C. Fine Aggregate: ASTM C33/C33M, except for gradation; natural or manufactured sands.

D. Admixtures: ASTM C494/C494M.

E. Water: Potable.

F. Reinforcing Bars: ASTM A615/A615M deformed bars, galvanized.
   1. Galvanized in accordance with ASTM A767/A767M, Class I.

G. Steel Welded Wire Reinforcement: ASTM A1064/A1064M, galvanized or ASTM A884/A884M, epoxy coated.

H. Embedded Anchors, Dowels, and Inserts: Type 304 stainless steel, of type and size as required for conditions.

I. Mortar: Portland cement-lime, ASTM C270 Type N ; do not use masonry cement.

J. Sealant: As specified in Section 07 9005.

K. Cleaner: General-purpose cleaner designed for removing mortar and grout stains, efflorescence, and other construction stains from new masonry surfaces without discoloring or damaging masonry surfaces; approved for intended use by cast stone manufacturer and by cleaner manufacturer for use on cast stone and adjacent masonry materials.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine construction to receive cast stone components. Notify Architect if construction is not acceptable.

B. Do not begin installation until unacceptable conditions have been corrected.

3.02 INSTALLATION

A. Install cast stone components in conjunction with masonry, complying with requirements of Section 04 2000.

B. Comply with manufacturer’s product data, including product technical bulletins, product catalog installation instructions and product carton instructions for installation.

C. Mechanically anchor cast stone units indicated; set remainder in mortar.

D. Setting:
   1. Drench cast stone components with clear, running water immediately before installation.
   2. Set units in a full bed of mortar unless otherwise indicated.
   3. Fill vertical joints with mortar.
   4. Fill dowel holes and anchor slots completely with mortar or non-shrink grout.

3.03 CLEANING

A. Clean completed exposed cast stone after mortar is thoroughly set and cured.
   1. Wet surfaces with water before applying cleaner.
   2. Apply cleaner to cast stone in accordance with manufacturer's instructions.
   3. Remove cleaner promptly by rinsing thoroughly with clear water.
   4. Do not use acidic cleaners.

3.04 PROTECTION

A. Protect completed work from damage.

B. Clean, repair, or restore damaged or mortar-splashed work to condition of new work.

END OF SECTION

SECTION 05 12 00

STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

1.01 DESCRIPTION

A. Work Included: All labor and materials required to furnish and install the structural steel work shown on the Drawings and required by these Specifications, including that shown on Mechanical or Electrical Drawings, or required in their Specification Sections.

B. Related Work Specified Elsewhere: The general provisions of the Contract apply to the work of this Section, as though reproduced herein. Carefully examine all other Sections and all Drawings for related work, which includes but is not limited to:

1.	Quality Requirements:	Section 01 40 00
2.	Cast-In-Place Concrete:	Section 03 30 00
3.	Masonry	Division 4
4.	Sprayed Fireproofing:	Section 07 81 00
5.	Finish Painting:	Division 9

C. Work Furnished but Installed Under Other Sections: Anchor rods, loose bearing and base plates, and loose lintels.

D. Work Affected By Others: Framing, bracing, loads, openings, and structure in any way related to Plumbing, HVAC, or Electrical requirements (if shown) is for bidding purposes only. Responsibility for coordinating the work of this Section with these requirements is solely that of the Contractor. Contractor's review of shop drawings will be taken to indicate that this coordination has been accomplished.

E. Inspection and testing required by this Section is to be at the Owner's expense.

1.02 QUALITY ASSURANCE

A. All structural steel construction shall comply with the governing codes including the latest adopted editions of the standards and material specifications referenced herein.

B. Reference Standards:

1. By the American Institute of Steel Construction (AISC):
    a. ANSI/AISC 360, Specification for Structural Steel Buildings.
    b. AISC 303, Code of Standard Practice for Steel Buildings and Bridges.
    c. AISC 341, Seismic Provisions for Structural Steel Buildings, including supplements.
    d. Specification of the Design of Steel Hollow Structural Sections.
2. By the Research Council on Structural Connections (RCSC).
    a. Specification for Structural Joints using High-Strength Bolts.
3. By the American Welding Society (AWS):
    a. Structural Welding Code - Steel ANSI/AWS D1.1.
    b. Standard Symbols for Welding, Brazing and Non-Destructive Examination, ANSI/AWS A2.4.
4. By the Society for Protective Coatings (SSPC):

a. Surface Preparation Specifications.
b. Painting System Specifications.

C. Fabricator's Qualifications:

1. Minimum five years' continuous experience in the fabrication of steel for projects of similar quality and scope.
2. Membership in the American Institute of Steel Construction, or approval of the Architect at least ten days prior to bid.
3. Certification by the American Institute of Steel Construction: Building QMS Certification (BU).

D. Erector's Qualifications:

1. Minimum five years' continuous experience in similar steel erection.
2. Certification by the American Institute of Steel Construction (CSE).

E. Welders' Qualifications: Personnel and procedures are to be qualified in accordance with ANSI/AWS D1.1.

F. Inspection Agency's Qualifications: Minimum three years' experience in similar steel inspection, and approval of the Architect.

1.03 SUBMITTALS

A. Certification of Experience: Submit, on request only, a written description of personnel, projects, and equipment which document the experience and qualifications required of the fabricator, inspection agency, erector and welders.

B. Shop Drawings of all structural steel components including erection plans and embedment plans.

1. Indicate all shop and erection details, including cuts, copes, camber, connections, holes, threaded fasteners, and welds.
2. Indicate material specifications and finishes.
3. Indicate shop and field welds with symbols per ANSI/AWS A2.4.
4. Base plate and anchor rod layout may be revised from that shown on the Structural Drawings, including quantity of anchor rods, in order to comply with OSHA requirements, subject to approval by the structural engineer during shop drawing submittals.

C. Product Data Indicating Proof of Compliance for Materials.

1. Mill test reports for properly identified material for:

a. Structural steel shapes.
b. High strength threaded fasteners (each type), nuts and washers.
c. Direct tension indicators, if used.

2. Structural Steel Primer Paint.
3. Shrinkage Resistant, Non-corrosive Grout.

D. Inspection Reports: Submit reports for the inspections specified.

1.04 PRODUCT DELIVERY AND STORAGE

A. Delivery:

1. Comply with ASTM A6. Non-compliance will be cause for rejection.
2. Deliver anchor rods and other items to be embedded in cast-in-place concrete or

masonry prior to the start of that work. Provide setting drawings, or directions for installation of anchor rods and other anchorage to be installed as work of other sections.

B. Storage:

1. Store steel at site above ground on platforms, skids or other supports.
2. Protect steel from corrosion.
3. Store fasteners in a protected place. Clean and relubricate bolts and nuts that become dry or rusty.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Rolled Wide Flange Shapes (W):

1. Fy = 50 ksi steel: ASTM A992.
2. All material shall be produced domestically.

B. Rolled Shapes (M, S, C and MC), Angles, Plates and Bars:

1. Fy = 36 ksi steel: ASTM A36.
2. All material shall be produced domestically.

C. Hollow Structural Sections (HSS):

1. Square/Rectangular: Fy = 46 ksi: ASTM A500, Grade B.
2. Round: Fy = 42 ksi: ASTM A500, Grade B.
3. All material shall be produced domestically.

D. Fasteners:

1. High Strength Threaded Fasteners:

   a. Bolts: ASTM A325 or A490, Type 1, heavy hex structural bolts.
   b. Nuts: ASTM A563.
   c. Washers: ASTM F436.

2. Anchor Rods, and Threaded Rods: Provide heavy nut and washers for anchor rods (both ends where shown).

   a. Anchor Rods: ASTM F1554, Grade 36.
   b. Threaded Rods: ASTM A36, Fy = 36 ksi.

3. Twist Off, Tension Control Bolts: ASTM F1852.
4. Direct-Tension Indicators: ASTM F959, Type A325 or Type 490, compatible with high strength threaded fasteners.

E. Welding Electrodes: Conform to requirements of ANSI/AWS D1, using Series E70 electrodes, appropriate for the materials being welded.

F. Shop Paint Primer (Gray):

1. SSPC Paint 25, Type II.
2. Galvanized steel to be painted: SSPC Paint 20.
3. Primer to be compatible with finish paint.

G. Masonry Anchors: 11 gage channel slots or 3/16-inch diameter wires, shop welded to structural steel.

H. Shrinkage Resistant, Non-Corrosive Grout: ASTM C1107/CE-CRD-C621.

2.02 FABRICATION

A. Conform to applicable provisions of the reference standards listed in Part 1 of this Section, as modified herein.

B. Columns that are part of the primary skeletal framing system should be fabricated with at least four (4) anchor rods arranged in a square or rectangular orientation in order to comply with OSHA regulations, even if shown with fewer rods on the Contract Drawings.

C. Connection Design:

1. Design connections per AISC standards for forces and moments given on the Drawings. Where none are given, design for the following:

a. For non-composite members use 1/2 of the Maximum Total Uniform Load on pages 3-35 through 3-79 of the Fourteenth Edition of the AISC Steel Construction Manual.

2. Connection type is to be:

a. Snug-tight joints unless noted otherwise.
b. Pre-tensioned or slip-critical joints are required in bolted connections of moment resisting joints/frames, braced frames, joints utilizing both bolts and welds or where specifically shown on the Construction Drawings. Provide twist-off, tension control bolts or direct-tension indicator washers at all locations.

3. Connection details on Drawings are to illustrate location, type, general arrangement only, and to establish minimum requirements.
4. Shop connections may be welded or bolted, unless shown otherwise.
5. Field connections shall be bolted, unless shown otherwise.

D. Finishing: Ends of members in direct contact bearing, such as columns at their bases and splices, are to be “finished,” as defined in the Code of Standard Practice.

E. Bearing and Base Plates: Column base plates are to be shop attached. Beam bearing plates may be attached or loose.

F. Holes: Drill or punch holes in members as required for items of other trades, bolts, passage of conduit and piping, and attachment of joists, nailers, etc. Thermal cutting of such holes is not permitted. If opening is not shown on Structural Drawings, obtain prior approval.

2.03 SHOP CLEANING AND PAINTING

A. Structural steel that does not require shop paint shall be cleaned of oil and grease with solvent cleaners, and of dirt and other foreign material by sweeping with a fiber brush or other suitable means.

B. Shop paint all structural steel members, except those members or portion of members to be embedded in concrete or masonry. Paint embedded steel that is partially exposed on exposed portions and initial 2 inches of embedded areas only.

1. Do not paint surfaces to receive sprayed fireproofing.
2. Do not paint surfaces to be welded, contact surfaces of slip-critical joints, surfaces to receive headed stud connectors, or members to be galvanized.

C. Surface Preparation: After inspection and before shipping, clean all steel to be painted. Remove loose rust, loose mill scale, dirt and other foreign matter. Prepare surfaces according to the Society for Protective Coatings (SSPC) as follows:

1. Interior steel concealed from view: SP1 and SP2.
2. Exterior steel, steel concealed in exterior walls and steel exposed to view: SP6.

D. Painting: Immediately after surface preparation, apply primer paint in accordance with the Manufacturer's instructions. Use painting methods which will result in full coverage of joints, corners, edges, and all exposed surfaces.

1. Interior steel concealed from view shall receive one coat of primer paint with a minimum dry film thickness of 2.0 mils.
2. Exterior steel, steel concealed in exterior walls and steel exposed to view shall receive two coats of primer paint with a minimum dry film thickness of 2.0 mils, each coat. Change color of second coat to distinguish it from the first.

2.04 Galvanizing

A. Where indicated on the Drawings, provide hot-dipped galvanized finish as follows:

1. Structural steel members according to ASTM A123.
2. Threaded fasteners according to ASTM A153.

B. Access holes if required for galvanizing shall be shown and labelled on the shop drawings. All access holes shall be permanently sealed prior to erection.

2.05 Source Quality Control

A. The Owner will engage an independent testing and inspecting agency to perform shop testing and inspections.

1. Provide testing agency with access to perform testing and inspections.

B. Correct deficiencies in work that test reports and inspections indicate are not in compliance with the Contract Documents.

C. Shop bolted connections will be inspected according to RCSC'S Specification for Structural Joints using ASTM A325 or A490 bolts.

D. Shop welded connections will be inspected and tested according to ANSI/AWS D1.1.

PART 3 - EXECUTION

3.01 SURFACE CONDITIONS

A. Prior to beginning work of this Section, verify that the installed work of other trades is complete and correct to the extent necessary for the proper execution of the work of this Section. This includes locations of anchor rods, lines and grades of bearings and embedded items.

B. In the event of discrepancies, immediately notify the Architect. Do not proceed with work affected by the discrepancies until they have been resolved.

3.02 ERECTION

A. Conform to the applicable provisions of the reference standards listed in Part 1 of this Section, as modified herein.

B. This structure is designed to be self-supporting and stable after the building is fully

completed. It is solely the Contractor's responsibility to determine erection procedures and sequence; and to ensure the stability of the building and its component parts, and the adequacy of temporary or incomplete connections, during erection. This includes the addition of whatever temporary bracing, guys, or tie-downs that might be necessary. Such material is not shown on the Drawings. If applied, they shall be removed as conditions permit, and shall remain the Contractor's property.

C. Safety: It is solely the Contractor's responsibility to follow all applicable safety codes and regulations governing this work.

D. Clean bearing surfaces and other surfaces in permanent contact, prior to assembly.

E. Splices are permitted only where indicated.

F. Tolerances: Per AISC Code of Standard Practice. Note special requirements therein for "Architecturally Exposed Structural Steel."

G. Field corrections of fabrication errors by gas/thermal cutting is not permitted.

H. Welds which are subject to foot traffic or are exposed to view in the finished structure are to be ground smooth and flush with adjacent surfaces.

I. Pack grout solidly between bearing surfaces and bases or plates to ensure that no voids remain. Finish exposed edges, protect installed materials, and allow to cure.

3.03 FIELD QUALITY CONTROL

A. Inspection agency shall perform the following:

1. Review qualifications of welders, operators, and welding procedures submitted by the Contractor.
2. Review materials' proofs of compliance if such are required.
3. Inspect bolted connections, according to RCSC'S Specification for Structural Joints using ASTM A325 or A490 bolts.
4. Inspect welded connections per the requirements of ANSI/AWS D1.1, Chapter 6. Welds requiring non-destructive tests are indicated on the Drawings.
5. Visually inspect connections using twist-off, tension control bolts to verify bolt installation is complete. Verify gaps of direct-tension indicators compressible washers comply with ASTM F959, Table 2.
6. Testing agency shall submit test reports promptly to the Architect and Contractor.
7. The Contractor shall correct deficiencies in the work that inspections and reports have indicated are not in compliance with specified requirements. Additional testing will be required to determine compliance of corrected work. Cost of additional testing shall be paid by the Contractor.

3.04 Field Touch-up Painting

A. Touch-up painting shall proceed immediately after erection is complete. Clean field welds, bolted connections and abraded areas of shop paint. Do not paint welds until they have been cleaned in accordance with ANSI/AWS D1.1. Apply paint to exposed areas using the same product as used for shop painting. Apply by brush or spray to provide a minimum dry film thickness of 2.0 mils.

B. Galvanizing Repair: Clean field welds, bolted connections and abraded areas and apply galvanizing repair paint according to ASTM A780.

END OF SECTION 05 12 00

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SECTION 05 50 00

METAL FABRICATIONS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Shop fabricated steel and aluminum items.

B. Prefabricated ladders and ship ladders.

C. Downspout boots.

1.02 RELATED REQUIREMENTS

A. Section 03 3000 - Cast-in-Place Concrete: Placement of metal fabrications in concrete.

B. Section 04 2000 - Unit Masonry: Placement of metal fabrications in masonry.

C. Section 04 2001 - Masonry Veneer: Placement of metal fabrications in masonry.

D. Section 04 2723 - Cavity Wall Unit Masonry: Placement of metal fabrications in masonry.

E. Section 04 2900 - Engineered Unit Masonry: Placement of metal fabrications in masonry.

F. Section 05 1200 - Structural Steel Framing: Structural steel column anchor bolts.

G. Section 05 5213 - Pipe and Tube Railings.

H. Section 07 7123 - Manufactured Gutters and Downspouts: Downspout boots.

I. Section 09 9113 - Exterior Painting: Paint finish.

J. Section 09 9123 - Interior Painting: Paint finish.

1.03 PRICE AND PAYMENT PROCEDURES

A. See Section 01 2200 - Unit Prices, for additional requirements.

B. Components:
   1. Basis of Measurement: By the pound.

C. Components:
   1. Basis of Measurement: By the unit.

1.04 REFERENCE STANDARDS

A. AAMA 2604 - Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix) 2017a.

B. ANSI A14.3 - American National Standard for Ladders -- Fixed -- Safety Requirements 2018.

C. ASTM A36/A36M - Standard Specification for Carbon Structural Steel 2014.

D. ASTM A48/A48M - Standard Specification for Gray Iron Castings 2003 (Reapproved 2016).

E. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc- Coated, Welded and Seamless 2018.

F. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products 2017.

G. ASTM A325 - Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength 2014.

H. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes 2020.

I. ASTM A501/A501M - Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing 2014.

J. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes 2014.

K. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric) 2013.

L. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination 2012.

M. AWS D1.1/D1.1M - Structural Welding Code - Steel 2015, with Errata (2016).

N. IAS AC172 - Accreditation Criteria for Fabricator Inspection Programs for Structural Steel 2018.

O. SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer 1999 (Ed. 2004).

P. SSPC-Paint 20 - Zinc-Rich Primers (Type I, "Inorganic," and Type II, "Organic") 2002 (Ed. 2004).

Q. SSPC-SP 2 - Hand Tool Cleaning 2018.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories. Include erection drawings, elevations, and details where applicable.
   1. Indicate welded connections using standard AWS A2.4 welding symbols. Indicate net weld lengths.

C. Welders' Certificates: Submit certification for welders employed on the project, verifying AWS qualification within the previous 12 months.

1.06 QUALITY ASSURANCE

A. Design [_____] under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed in State of Ohio.

B. Fabricator Qualifications: A qualified steel fabricator that is accredited by IAS AC172.

PART 2 PRODUCTS

2.01 MATERIALS - STEEL

A. Steel Sections: ASTM A 36/A 36M.

B. Pipe: ASTM A 53/A 53M Grade B Schedule 40, black finish.

C. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.

D. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20, Type I - Inorganic, complying with VOC limitations of authorities having

jurisdiction.

2.02 MATERIALS - ALUMINUM

A. Extruded Aluminum: ASTM B221 (ASTM B221M), 6063 alloy, T6 temper.

2.03 FABRICATION

A. Fit and shop assemble items in largest practical sections, for delivery to site.

B. Fabricate items with joints tightly fitted and secured.

C. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.

D. Supply components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.

2.04 FABRICATED ITEMS

A. Ladders: Steel; in compliance with ANSI A14.3; with mounting brackets and attachments; prime paint finish.
   1. Side Rails: 3/8 x 2 inches members spaced at 20 inches.
   2. Rungs: one inch diameter solid round bar spaced 12 inches on center.
   3. Space rungs 7 inches from wall surface.

B. Bollards: Steel pipe, concrete filled, crowned cap, as detailed; prime and paint finish.

C. Lintels: As detailed; galvanized, prime and paint finish.

D. Elevator Hoistway Divider Beams: Beam sections; prime paint finish.

2.05 PREFABRICATED LADDERS

A. Prefabricated Ladder: Welded metal unit complying with ANSI A14.3; factory fabricated to greatest degree practical and in the largest components possible.
   1. Components: Manufacturer's standard rails, rungs, treads, handrails. returns, platforms and safety devices complying with the requirements of the MATERIALS article of this section.
   2. Finish: Stainless steel; No. 1 finish.
   3. Manufacturers:
      a. O'Keeffe's Inc; Model 500: www.okeeffes.com/#sle.
      b. Substitutions: See Section 01 6000 - Product Requirements.

B. Prefabricated Ship Ladder: Welded metal unit complying with ANSI A14.3; factory fabricated to greatest degree practical and in the largest components possible.
   1. Components: Manufacturer's standard rails, rungs, treads, handrails. returns, platforms and safety devices complying with the requirements of the MATERIALS article of this section.
   2. Finish: Stainless steel; No. 1 finish.
   3. Manufacturers:
      a. O'Keeffe's Inc; Model 520: www.okeeffes.com/#sle.
      b. Substitutions: See Section 01 6000 - Product Requirements.

2.06 DOWNSPOUT BOOTS

A. Downspout Boots: Smooth interior without boxed corners or choke points;

include integral lug slots, integral cleanout, cleanout cover, and tamper proof fasteners.

1. Configuration: Angular.
2. Material: Cast iron; ASTM A48/A48M; casting thickness 3/8 inch (9.5 mm), minimum.
3. Finish: Manufacturer's standard factory applied powder coat finish.
4. Accessories: Manufacturer's standard stainless steel fasteners, stainless steel building wall anchors, integral neoprene gaskets, and rubber coupling.

2.07 FINISHES - STEEL

A. Prime paint steel items.
   1. Exceptions: Do not prime surfaces in direct contact with concrete, where field welding is required, and items to be covered with sprayed fireproofing.

B. Prepare surfaces to be primed in accordance with SSPC-SP2.

C. Clean surfaces of rust, scale, grease, and foreign matter prior to finishing.

D. Prime Painting: One coat.

E. Galvanizing of Structural Steel Members: Galvanize after fabrication to ASTM A123/A123M requirements.

F. Galvanizing of Non-structural Items: Galvanize after fabrication to ASTM A123/A123M requirements.

2.08 FINISHES - ALUMINUM

A. High Performance Organic Coating System: AAMA 2604 multiple coat, thermally cured fluoropolymer system; color as indicated.

B. Apply one coat of bituminous paint to concealed aluminum surfaces in contact with cementitious or dissimilar materials.

2.09 FABRICATION TOLERANCES

A. Squareness: 1/8 inch maximum difference in diagonal measurements.

B. Maximum Offset Between Faces: 1/16 inch.

C. Maximum Misalignment of Adjacent Members: 1/16 inch.

D. Maximum Bow: 1/8 inch in 48 inches.

E. Maximum Deviation From Plane: 1/16 inch in 48 inches.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive work.

3.02 PREPARATION

A. Clean and strip primed steel items to bare metal where site welding is required.

B. Supply setting templates to the appropriate entities for steel items required to be cast into concrete or embedded in masonry.

3.03 INSTALLATION

A. Install items plumb and level, accurately fitted, free from distortion or defects.

B. Provide for erection loads, and for sufficient temporary bracing to

maintain true alignment until completion of erection and installation of permanent attachments.

C. Field weld components as indicated on drawings.

D. Perform field welding in accordance with AWS D1.1/D1.1M.

E. Obtain approval prior to site cutting or making adjustments not scheduled.

3.04 TOLERANCES

A. Maximum Variation From Plumb: 1/4 inch per story, non-cumulative.

B. Maximum Offset From True Alignment: 1/4 inch.

C. Maximum Out-of-Position: 1/4 inch.

END OF SECTION

SECTION 05 52 13

PIPE AND TUBE RAILINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Wall mounted handrails.

B. Stair railings and guardrails.

1.02 RELATED REQUIREMENTS

A. Section 09 9123 - Interior Painting: Paint finish.

1.03 REFERENCE STANDARDS

A. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum 2014 (2015 Errata).

B. AAMA 2603 - Voluntary Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix) 2017a.

C. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design 2010.

D. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc- Coated, Welded and Seamless 2018.

E. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products 2017.

F. ASTM B241/B241M - Standard Specification for Aluminum and Aluminum-Alloy Seamless Pipe and Seamless Extruded Tube 2016.

G. ASTM B429/B429M - Standard Specification for Aluminum-Alloy Extruded Structural Pipe and Tube 2010e1.

H. ASTM B483/B483M - Standard Specification for Aluminum and Aluminum-Alloy Drawn Tubes for General Purpose Applications 2020.

I. ASTM E935 - Standard Test Methods for Performance of Permanent Metal Railing Systems and Rails for Buildings 2013, with Editorial Revision.

J. ASTM E985 - Standard Specification for Permanent Metal Railing Systems and Rails for Buildings 2000 (Reapproved 2006).

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate profiles, sizes, connection attachments, anchorage, size and type of fasteners, and accessories.

C. Samples: Submit two, 12 inch long samples of handrail. Submit two samples of elbow, wall bracket, and end stop.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Handrails and Railings:

1. C.R. Laurence Company, Inc; CRL Welded Post Railing Systems (WRS): www.crl-arch.com/#sle.
2. KaneSterling; [___]: www.sterlingdula.com/#sle.
3. Superior Aluminum Products: www.superioraluminum.com
4. The Wagner Companies; [__]: www.wagnercompanies.com/#sle.

B. Non-Weld Pipe Fittings:

2.02 RAILINGS - GENERAL REQUIREMENTS

A. Design, fabricate, and test railing assemblies in accordance with the most stringent requirements of ASTM E985 and applicable local code.

B. Distributed Loads: Design railing assembly, wall rails, and attachments to resist distributed force of 75 pounds per linear foot applied to the top of the assembly and in any direction, without damage or permanent set. Test in accordance with ASTM E 935.

C. Concentrated Loads: Design railing assembly, wall rails, and attachments to resist a concentrated force of 200 pounds applied at any point on the top of the assembly and in any direction, without damage or permanent set. Test in accordance with ASTM E 935.

D. Allow for expansion and contraction of members and building movement without damage to connections or members.

E. Dimensions: See drawings for configurations and heights.

F. Provide anchors and other components as required to attach to structure, made of same materials as railing components unless otherwise indicated; where exposed fasteners are unavoidable provide flush countersunk fasteners.

G. Provide slip-on non-weld mechanical fittings to join lengths, seal open ends, and conceal exposed mounting bolts and nuts, including but not limited to elbows, T- shapes, splice connectors, flanges, escutcheons, and wall brackets.

2.03 ALUMINUM MATERIALS

A. Aluminum Pipe: Schedule 40; ASTM B429/B429M, ASTM B241/B241M, or ASTM B483/B483M.

B. Non-Weld Mechanical Fittings: Slip-on cast aluminum, for Schedule 40 pipe, with flush setscrews for tightening by standard hex wrench, no bolts or screw fasteners.

C. Exposed Fasteners: No exposed bolts or screws.

2.04 FABRICATION

A. Accurately form components to suit specific project conditions and for proper connection to building structure.

B. Fit and shop assemble components in largest practical sizes for delivery to site.

C. Fabricate components with joints tightly fitted and secured. Provide spigots and sleeves to accommodate site assembly and installation.

2.05 ALUMINUM FINISHES

A. Where indicated as Clear Anodized provide Class I Natural Anodized Finish: AAMA 611 AA-M12C22A41 Clear anodic coating not less than 0.7 mils thick.

B. Superior Performance Organic Coating System: AAMA 2605 multiple coat, thermally cured polyvinylidene fluoride system.

C. Color: To be selected by Architect from manufacturer's standard line.

D. Touch-Up Materials: As recommended by coating manufacturer for field application.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive work.

3.02 PREPARATION

A. Clean and strip primed steel items to bare metal where site welding is required.

B. Supply items required to be cast into concrete or embedded in masonry with setting templates, for installation as work of other sections.

C. Apply one coat of bituminous paint to concealed aluminum surfaces that will be in contact with cementitious or dissimilar materials.

3.03 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install components plumb and level, accurately fitted, free from distortion or defects, with tight joints.

C. Install railings in compliance with ADA Standards for accessible design at applicable locations.

D. Anchor railings securely to structure.

E. Field weld anchors as indicated on drawings. Touch-up welds with primer. Grind welds smooth.

F. Conceal anchor bolts and screws whenever possible. Where not concealed, use flush countersunk fastenings.

3.04 TOLERANCES

A. Maximum Variation From Plumb: 1/4 inch per floor level, non-cumulative.

B. Maximum Offset From True Alignment: 1/4 inch.

C. Maximum Out-of-Position: 1/4 inch.

END OF SECTION

SECTION 05 70 00

DECORATIVE METAL RAILINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Railing and guardrail assemblies.

1.02 REFERENCE STANDARDS

A. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum 2014 (2015 Errata).

B. AAMA 2604 - Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix) 2017a.

C. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design 2010.

D. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc- Coated, Welded and Seamless 2018.

E. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength 2014, with Editorial Revision (2017).

F. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes 2014.

G. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric) 2013.

H. ASTM E935 - Standard Test Methods for Performance of Permanent Metal Railing Systems and Rails for Buildings 2013, with Editorial Revision.

I. ASTM E985 - Standard Specification for Permanent Metal Railing Systems and Rails for Buildings 2000 (Reapproved 2006).

J. AWS C3.4M/C3.4 - Specification for Torch Brazing 2016.

K. AWS C3.4M/C3.4 - Specification for Torch Brazing 2016.

L. AWS C3.5M/C3.5 - Specification for Induction Brazing 2016 (Amended 2017).

M. AWS C3.9M/C3.9 - Specification for Resistance Brazing 2009.

N. AWS C3.5/C 3.5M - Specification for Induction Brazing; American Welding Society; 2007.

O. AWS C3.9/C 3.9M - Specification for Resistance Brazing; American Welding Society; 2009.

P. AWS D1.1/D1.1M - Structural Welding Code - Steel 2015, with Errata (2016).

Q. AWS D1.6/D1.6M - Structural Welding Code - Stainless Steel 2017.

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Submit manufacturer's product data including description of

materials, components, finishes, fabrication details, glass, anchors, and accessories.

C. Shop Drawings: Indicate railing system elevations and sections, details of profile, dimensions, sizes, connection attachments, anchorage, size and type of fasteners, and accessories. Indicate anchor and joint locations, brazed connections, transitions, and terminations.

D. Samples: Submit one (1) of each item below for each type and condition shown.
   1. Railing: 12 inch long section of handrail illustrating color, finish and connection detail.

E. Test Reports: Submit test reports from an independent testing agency showing compliance with specified design and performance requirements.

F. Maintenance Data: Manufacturer's instructions for care and cleaning.

G. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.04 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in installing decorative stairs and railing systems and acceptable to manufacturer.

B. Mock-Ups: Construct an example of each item specified. Locate mock-ups where directed. Mock-ups may remain as part of the work.

1.05 MOCK-UP

A. Locate where directed.

B. Mock-up may remain as part of the Work.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in factory provided protective coverings and packaging.

B. Protect materials against damage during transit, delivery, storage, and installation at site.

C. Inspect materials upon delivery for damage. Repair damage to be indistinguishable from undamaged areas; if damage cannot be repaired to be indistinguishable from undamaged parts and finishes, replace damaged items.

D. Prior to installation, store materials and components under cover, in a dry location.

1.07 FIELD CONDITIONS

A. Do not install railings until project is enclosed and ambient temperature of space is minimum 65 degrees F and maximum 95 degrees F.

B. Maintain ambient temperature of space at minimum 65 degrees F and maximum 95 degrees F for 24 hours before, during, and after railing installation.

1.08 WARRANTY

A. Warranty: Manufacturer's standard one year warranty against defects in materials, fabrication, finishes, and installation commencing on Date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Decorative Metal Railings: Superior Aluminum Products, Inc; 550 Aluminum Pipe Picket Railing
   1. Architectural Railings and Grilles, Inc: www.stainless-railing.com.
   2. Couturier Iron Craft, Inc; [_____]: www.couturierironcraft.com/#sle.
   3. C. R. Laurence Company, Inc; [_____]: www.crl-arch.com/#sle.
   4. Global Glass Railings; Hercules system (base mounted): www.architecturalglassrailings.com/#sle.
   5. Substitutions: See Section 01 6000 - Product Requirements.

2.02 RAILING SYSTEMS

A. Railing Systems - General: Factory- or shop-fabricated in design indicated, to suit specific project conditions, and for proper connection to building structure, and in largest practical sizes for delivery to site.
   1. Performance Requirements: Design and fabricate railings and anchorages to resist the following loads without failure, damage, or permanent set; loads do not need to be applied simultaneously.
      a. Lateral Force: 75 lb minimum, at any point, when tested in accordance with ASTM E935.
      b. Distributed Load: 50 lb/ft minimum, applied in any direction at the top of the handrail, when tested in accordance with ASTM E935.
      c. Concentrated Loads on Intermediate Rails: 50 psf, minimum.
      d. Concentrated Load: 200 lbs minimum, applied in any direction at any point along the handrail system, when tested in accordance with ASTM E935.
      e. Handrails: Comply with applicable accessibility requirements of ADA Standards.
   2. Assembly: Join lengths, seal open ends, and conceal exposed mounting bolts and nuts using slip-on non-weld mechanical fittings, flanges, escutcheons, and wall brackets.
   3. Joints: Tightly fitted and secured, machined smooth with hairline seams.
   4. Field Connections: Provide sleeves to accommodate site assembly and installation.
   5. Welded and Brazed Joints: Make exposed joints butt tight, flush, and hairline; use methods that avoid discoloration and damage of finish; grind smooth, polish, and restore to required finish.
      a. Ease exposed edges to small uniform radius.
      b. Welded Joints:
         1) Carbon Steel: Perform welding in accordance with AWS D1.1/D1.1M.
         2) Stainless Steel: Perform welding in accordance with AWS D1.6/D1.6M.
      c. Brass/Bronze Brazed Joints:
         1) Perform torch brazing in accordance with AWS C3.4M/C3.4.
         2) Perform induction brazing in accordance with AWS C 3.5/C 3.5M.
         3) Perform resistance brazing in accordance with AWS C 3.9/C 3.9M.

B. Metal Tube Railing: Engineered, post supported railing system with metal infill.
   1. Configuration: per basis-of-design.
   2. Decorative Flanges for Embedded Posts: Circular, collared cover plate

without screw holes.
3. Wall Mounted Components: Components necessary to support railing with 1-1/2 inch clearance from wall, and as follows:
4. Fasteners: Concealed.

2.03 MATERIALS

A. Aluminum Components: ASTM B221 or ASTM B221M.
1. Tubes: Schedule 40 pipe.
2. High Performance Organic Finish: AAMA 2604; multiple coats, thermally cured fluoropolymer system.

2.04 ACCESSORIES

A. Non-Weld Mechanical Fittings for Aluminum Railings: In-line aluminum fittings, with flush setscrews for tightening by standard hex wrench, no bolts or screw fasteners.

B. Welding Fittings: Factory- or shop-welded from matching pipe or tube; joints and seams ground smooth.

C. Anchors and Fasteners: Provide anchors and other materials as required to attach to structure, made of same materials as railing components unless otherwise indicated; where exposed fasteners are unavoidable provide flush countersunk fasteners.
1. For anchorage to concrete, provide inserts to be cast into concrete for bolting anchors.
2. For anchorage to masonry, provide brackets to be embedded in masonry for bolting anchors.
3. For anchorage to stud walls, provide backing plates for bolting anchors.
4. Exposed Fasteners: No exposed bolts or screws.

D. Carbon Steel Bolts and Nuts: ASTM A307.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrate and site conditions are acceptable and ready to receive work.

B. Verify field dimensions of locations and areas to receive work.

C. Notify Architect immediately of conditions that would prevent satisfactory installation.

D. Do not proceed with work until detrimental conditions have been corrected.

E. Furnish components to be installed in other work to installer of that other work, including but not limited to blocking, sleeves, inserts, anchor bolts, embedded plates and supports for attachment of anchors.

3.02 PREPARATION

A. Review installation drawings before beginning installation. Coordinate diagrams, templates, instructions and directions for installation of anchorages and fasteners.

B. Clean surfaces to receive units. Remove materials and substances detrimental to the installation.

3.03 INSTALLATION

A. Comply with manufacturer's drawings and written instructions.

B. Install components plumb and level, accurately fitted, free from distortion or defects and with tight joints, except where necessary for expansion.

C. Anchor securely to structure.

D. Conceal anchor bolts and screws whenever possible. Where not concealed, use flush countersunk fastenings.

E. Isolate dissimilar materials with bituminous coating, bushings, grommets or washers to prevent electrolytic corrosion.

3.04 TOLERANCES

A. Maximum Variation From Plumb: 1/4 inch per floor level, non-cumulative.

B. Maximum Offset From True Alignment: 1/4 inch.

C. Maximum Out-of-Position: 1/4 inch.

3.05 FIELD QUALITY CONTROL

A. Field Services: Provide the services of the manufacturer for field observation of installation of railings.

3.06 CLEANING

A. Remove protective film from exposed metal surfaces.

B. Metal: Clean exposed metal finishes with potable water and mild detergent, in accordance with manufacturer recommendations; do not use abrasive materials or chemicals, detergents or other substances that may damage the material or finish.

3.07 PROTECTION

A. Protect installed components and finishes from damage after installation.

B. Repair damage to exposed finishes to be indistinguishable from undamaged areas.

1. If damage to finishes and components cannot be repaired to be indistinguishable from undamaged finishes and components, replace damaged items.

END OF SECTION

SECTION 06 10 00

ROUGH CARPENTRY

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Rough opening framing for doors, windows, and roof openings.
B. Sheathing.
C. Subflooring.
D. Underlayment.
E. Roof-mounted curbs.
F. Roofing nailers.
G. Preservative treated wood materials.
H. Fire retardant treated wood materials.
I. Miscellaneous framing and sheathing.
J. Communications and electrical room mounting boards.
K. Concealed wood blocking, nailers, and supports.
L. Roof sheathing with factory applied roofing underlayment.

1.02 RELATED REQUIREMENTS

A. Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions.
B. Section 03 5400 - Cast Gypsum Based Underlayment.
C. Section 05 1200 - Structural Steel Framing: Prefabricated beams and columns for support of wood framing.
D. Section 05 5000 - Metal Fabrications: Miscellaneous steel connectors and support angles for wood framing.
E. Section 06 0573 - Wood Treatment: Field-applied termiticide and mildicide for wood.
F. Section 06 1500 - Wood Decking.
G. Section 06 1753 - Shop-Fabricated Wood Trusses.
H. Section 07 2500 - WEATHER BARRIERS: Water-resistive barrier over sheathing.
I. Section 07 6200 - Sheet Metal Flashing and Trim: Sill flashings.
J. Section 09 2116 - Gypsum Board Assemblies: Gypsum-based sheathing.

1.03 REFERENCE STANDARDS

A. APA PRP-108 - Performance Standards and Qualification Policy for Structural-Use Panels (Form E445); 2001.
B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware 2009.
C. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated

(Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2020.

D. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2020.

E. AWPA U1 - Use Category System: User Specification for Treated Wood 2012.

F. PS 1 - Structural Plywood 2009.

G. PS 2 - Performance Standard for Wood-Based Structural-Use Panels 2010.

H. PS 20 - American Softwood Lumber Standard 2010.

I. SPIB (GR) - Grading Rules 2014.

J. WWPA G-5 - Western Lumber Grading Rules 2011.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide technical data on insulated sheathing, wood preservative materials, and application instructions.

C. Structural Composite Lumber: Submit manufacturer's published structural data including span tables, marked to indicate which sizes and grades are being used; if structural composite lumber is being substituted for dimension lumber or timbers, submit grading agency structural tables marked for comparison.

D. Samples: For rough carpentry members that will be exposed to view, submit two samples, 24by24 inch in size illustrating wood grain, color, and general appearance.

E. Manufacturer's Certificate: Certify that wood products supplied for rough carpentry meet or exceed specified requirements.

F. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.05 DELIVERY, STORAGE, AND HANDLING

A. General: Cover wood products to protect against moisture. Support stacked products to prevent deformation and to allow air circulation.

1.06 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Correct defective Work within a five year period after Date of Substantial Completion.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

A. Dimension Lumber: Comply with PS 20 and requirements of specified grading agencies.

1. If no species is specified, provide any species graded by the agency specified; if no grading agency is specified, provide lumber graded by any grading agency meeting the specified requirements.
2. Grading Agency: Any grading agency whose rules are approved by the Board of Review, American Lumber Standard Committee (www.alsc.org) and who provides grading service for the species and grade specified;

provide lumber stamped with grade mark unless otherwise indicated.

3. Lumber of other species or grades is acceptable provided structural and appearance characteristics.

B. Lumber fabricated from old growth timber is not permitted.

2.02 DIMENSION LUMBER FOR CONCEALED APPLICATIONS

A. Grading Agency: Western Wood Products Association; WWPA G-5.

B. Sizes: Nominal sizes as indicated on drawings, S4S.

C. Moisture Content: S-dry or MC19.

D. Stud Framing (2 by 2 through 2 by 6):
1. Species: Any allowed under referenced grading rules and meeting requirements stipulated on the drawings or elswhere in the project manual.
2. Grade: No. 2.

E. Miscellaneous Framing, Blocking, Nailers, Grounds, and Furring:
1. Lumber: S4S, No. 2 or Standard Grade.
2. Boards: Standard or No. 3.

2.03 EXPOSED DIMENSION LUMBER

A. Grading Agency: Western Wood Products Association; WWPA G-5.

B. Sizes: Nominal sizes as indicated on drawings.

C. Surfacing: S4S.

D. Moisture Content: S-dry or MC19.

2.04 STRUCTURAL COMPOSITE LUMBER

A. At Contractor's option, structural composite lumber may be substituted for concealed dimension lumber and timbers.

B. Structural Composite Lumber: Factory fabricated beams, headers, and columns, of sizes and types indicated on drawings; structural capacity as published by manufacturer.
1. Beams: Use laminated veneer lumber, laminated strand lumber, or parallel strand lumber with manufacturer's published E (modulus of elasticity): 1,800,000 psi, minimum.
2. Manufacturers:
a. Weyerhaeuser Company; [__]: www.weyerhaeuser.com/#sle.
b. Boise Cascade; [___]: www.bc.com.
c. Georgia-Pacific Corp.; [___]: www.buildgp.com.

2.05 CONSTRUCTION PANELS

A. Subfloor/Underlayment Combination: Any PS 2 type, rated Single Floor.
1. Bond Classification: Exterior.
2. Span Rating: 24.
3. Performance Category: 3/4 PERF CAT.
4. Thickness: 3/4 inches, nominal.
5. Edges: Tongue and groove.

B. Subflooring: APA PRP-108: Rated Sheathing.
1. Exposure Class: Exterior.
2. Span Rating: 32/16 inches.

3. Thickness: 3/4 inch, nominal.

C. Roof Sheathing: APA PRP-108, Rated Sheathing, Exterior Exposure Class, and as follows:
   1. Span Rating: 24/0.
   2. Thickness: ,5/8" nominal.

D. Roof Sheathing: Oriented strand board wood structural panel; PS 2.
   1. Grade: Sheathing.
   2. Performance Category: 1/2 PERF CAT.
   3. Span Rating: 32/16.
   4. Edges: Square with panel clips.
   5. Exposure Time: Sheathing will not delaminate or require sanding due to moisture absorption from exposure to weather for up to 500 days.
   6. Provide fastening guide on top panel surface with separate markings indicating fastener spacing for 16 inches and 24 inches on center, respectively.
   7. Manufacturers:
      a. Huber Engineered Woods, LLC; AdvanTech Sheathing: www.huberwood.com/#sle.
      b. Substitutions: See Section 01 6000 - Product Requirements.

E. Wall Sheathing: APA PRP-108, Structural I Rated Sheathing, Exterior Exposure Class, and as follows:
   1. Span Rating: 24/0.

F. Wall Sheathing: Oriented strand board structural wood panel; PS 2.
   1. Bond Classification: Exposure 1.
   2. Size: 4 feet wide by 8 feet long.
   3. Edge Profile: Square edge.

G. Communications and Electrical Room Mounting Boards: PS 1 A-D plywood, or medium density fiberboard; 3/4 inch thick; flame spread index of 25 or less, smoke developed index of 450 or less, when tested in accordance with ASTM E84.

2.06 ACCESSORIES

A. Fasteners and Anchors:
   1. Metal and Finish: Hot-dipped galvanized steel complying with ASTM A153/A153M for high humidity and preservative-treated wood locations, unfinished steel elsewhere.
   2. Drywall Screws: Bugle head, hardened steel, power driven type, length three times thickness of sheathing.

B. Die-Stamped Connectors: Hot dipped galvanized steel, sized to suit framing conditions.
   1. For contact with preservative treated wood in exposed locations, provide minimum G185 galvanizing complying with ASTM A653/A653M.

C. Joist Hangers: Hot dipped galvanized steel, sized to suit framing conditions.

D. Sill Gasket on Top of Foundation Wall: 1/4 inch thick, plate width, closed cell plastic foam from continuous rolls. Provide [_____] manufactured by [_____] .

E. Sill Flashing: As specified in Section 07 6200.

F. Subfloor Adhesives: Waterproof, air cure type, cartridge dispensed.

G. Water-Resistive Barrier: As specified in Section 07 2500.

2.07 FACTORY WOOD TREATMENT

A. Treated Lumber and Plywood: Comply with requirements of AWPA U1 - Use Category System for wood treatments determined by use categories, expected service conditions, and specific applications.
   1. Fire-Retardant Treated Wood: Mark each piece of wood with producer's stamp indicating compliance with specified requirements.
   2. Preservative-Treated Wood: Provide lumber and plywood marked or stamped by an ALSC-accredited testing agency, certifying level and type of treatment in accordance with AWPA standards.

B. Fire Retardant Treatment:
   1. Manufacturers:
      a. Lonza Group; [___]: www.wolmanizedwood.com/#sle.
      b. Hoover Treated Wood Products, Inc; [_]: www.frtw.com/#sle.
      c. Koppers, Inc; [___]: www.koppersperformancechemicals.com/#sle.
      d. Substitutions: See Section 01 6000 - Product Requirements.

C. Preservative Treatment:
   1. Preservative Pressure Treatment of Lumber Above Grade: AWPA U1, Use Category UC3B, Commodity Specification A using waterborne preservative.
      a. Kiln dry lumber after treatment to maximum moisture content of 19 percent.
      b. Treat lumber exposed to weather.
      c. Treat lumber in contact with roofing, flashing, or waterproofing.
      d. Treat lumber in contact with masonry or concrete.

PART 3 EXECUTION

3.01 PREPARATION

A. Install sill gasket under sill plate of framed walls bearing on foundations; puncture gasket cleanly to fit tightly around protruding anchor bolts.

B. Coordinate installation of rough carpentry members specified in other sections.

3.02 INSTALLATION - GENERAL

A. Select material sizes to minimize waste.

B. Reuse scrap to the greatest extent possible; clearly separate scrap for use on site as accessory components, including: shims, bracing, and blocking.

C. Where treated wood is used on interior, provide temporary ventilation during and immediately after installation sufficient to remove indoor air contaminants.

3.03 BLOCKING, NAILERS, AND SUPPORTS

A. Provide framing and blocking members as indicated or as required to support finishes, fixtures, specialty items, and trim.

B. In framed assemblies that have concealed spaces, provide solid wood fireblocking as required by applicable local code, to close concealed draft openings between floors and between top story and roof/attic space; other material acceptable to code authorities may be used in lieu of solid wood blocking.

C. In metal stud walls, provide continuous blocking around door and window

openings for anchorage of frames, securely attached to stud framing.

D. In walls, provide blocking attached to studs as backing and support for wall-mounted items, unless item can be securely fastened to two or more studs or other method of support is explicitly indicated.

E. Where ceiling-mounting is indicated, provide blocking and supplementary supports above ceiling, unless other method of support is explicitly indicated.

F. Provide the following specific non-structural framing and blocking:
   1. Cabinets and shelf supports.
   2. Wall brackets.
   3. Handrails.
   4. Grab bars.
   5. Towel and bath accessories.
   6. Wall-mounted door stops.
   7. Chalkboards and marker boards.
   8. Wall paneling and trim.
   9. Joints of rigid wall coverings that occur between studs.

3.04 ROOF-RELATED CARPENTRY

A. Coordinate installation of roofing carpentry with deck construction, framing of roof openings, and roofing assembly installation.

B. Provide wood curb at all roof openings except[__] where specifically indicated otherwise. Form corners by alternating lapping side members.

3.05 INSTALLATION OF CONSTRUCTION PANELS

A. Subflooring/Underlayment Combination: Glue and nail to framing; staples are not permitted.

B. Subflooring: Glue and nail to framing; staples are not permitted.

C. Space or gap subflooring in accordance with the manufacturer's instructions.

D. Roof Sheathing: Secure panels with long dimension perpendicular to framing members, with ends staggered and over firm bearing.
   1. At long edges provide solid edge blocking where joints occur between roof framing members.
   2. Nail panels to framing; staples are not permitted.

E. Wall Sheathing: Secure with long dimension perpendicular to wall studs, with ends over firm bearing and staggered, using nails or screws.
   1. Provide 1/8" gap minimum between panel ends and edges. Use a spacer tool to assure accurate and consistent spacing.
   2. Place water-resistive barrier horizontally over wall sheathing, weather lapping edges and ends.

F. Communications and Electrical Room Mounting Boards: Secure with screws to studs with edges over firm bearing; space fasteners at maximum 24 inches on center on all edges and into studs in field of board.
   1. At fire-rated walls, install board over wall board indicated as part of the fire-rated assembly.
   2. Where boards are indicated as full floor-to-ceiling height, install with long edge of board parallel to studs.
   3. Install adjacent boards without gaps.

G. Wall Sheathing and Roof Sheathing with Laminated Water-Resistive Barrier and Air Barrier: Secure to studs as recommended by manufacturer.
   1. Install with laminated water-resistive and air barrier on exterior side of sheathing.
   2. Do not bridge building expansion joints; cut and space edges of panels to match spacing of structural support elements.
   3. Use only mechanically attached and drainable EIFS and exterior insulation with wall sheathing with laminated water-resistive and air barrier.
   4. Apply manufacturer's standard seam tape to joints between sheathing panels. Use tape gun or hard rubber roller as recommended by manufacturer.

3.06 TOLERANCES

A. Framing Members: 1/4 inch from true position, maximum.

B. Surface Flatness of Floor: 1/8 inch in 10 feet maximum, and 1/4 inch in 30 feet maximum.

C. Variation from Plane (Other than Floors): 1/4 inch in 10 feet maximum, and 1/4 inch in 30 feet maximum.

3.07 CLEANING

A. Waste Disposal: Comply with the requirements of Section 01 7419 - Construction Waste Management and Disposal.
   1. Comply with applicable regulations.
   2. Do not burn scrap on project site.
   3. Do not burn scraps that have been pressure treated.
   4. Do not send materials treated with pentachlorophenol, CCA, or ACA to co- generation facilities or “waste-to-energy” facilities.

B. Do not leave any wood, shavings, sawdust, etc. on the ground or buried in fill.

C. Prevent sawdust and wood shavings from entering the storm drainage system.

END OF SECTION

SECTION 06 11 00

WOOD FRAMING

PART 1 - GENERAL

1.01 DESCRIPTION

A. Work Included: All labor and materials for structural lumber and sheathing shown on the Drawings for walls, roof and floor framing, including all connections and accessory materials shown on the Drawings and required by this Section, or necessary for a complete installation.

B. Related Work Specified Elsewhere: The general provisions of the Contract apply to the work of this Section, as though reproduced herein. Carefully examine all other Sections and all Drawings for related work, which includes but is not limited to:

1.	Quality Requirements:	Section 01 40 00
2.	Cast-In-Place Concrete:	Section 03 30 00
3.	Masonry:	Division 4
4.	Structural Steel Framing:	Section 05 12 00
5.	Prefabricated Wood Trusses:	Section 06 17 53

1.02 QUALITY ASSURANCE

A. All wood framing construction shall conform with the governing codes including the latest adopted editions of the standards and material specifications referenced herein.

B. Reference Standards:

1. The structural design is based on ANSI/AWC NDS “National Design Specification for Wood Construction by the American Wood Council (AWC).
2. Lumber shall comply with US DOC PS 20, American Softwood Lumber Standard with applicable grading rules of inspection agencies certified by American Lumber Standard Committee’s (ALSC) Board of Review.
3. All Wood Structural Panels shall comply with US DOC PS 1 and US DOC PS 2 and the Standards of The American Plywood Association.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Lumber: Spruce-Pine-Fir No. 2 or better, surfaced at 19% moisture content. Minimum Base Design Values for Visually Graded Dimension Lumber before adjustment are as follows:

1.	Bending, Fb:	875 psi
2.	Tension Parallel to Grain, Ft:	450 psi
3.	Shear Parallel to Grain, Fv:	135 psi
4.	Compression Perpendicular to Grain, Fc⊥:	425 psi
5.	Compression Parallel to Grain, Fc:	1,150 psi
6.	Modulus of Elasticity, E:	1,400,000 psi

B. Pre-Cut Wall Studs: Spruce-Pine-Fir Stud Grade or better, surfaced at 19% moisture content. Minimum Base Design Values for Visually Graded Dimension Lumber before adjustment are as follows:

1. Bending, Fb: 675 psi
2. Tension Parallel to Grain, Ft: 350 psi
3. Shear Parallel to Grain, Fv: 135 psi
4. Compression Perpendicular to Grain, Fc⊥: 425 psi
5. Compression Parallel to Grain, Fc: 725 psi
6. Modulus of Elasticity, E: 1,200,000 psi

C. Wood Structural Panels:

1. Roof: 5/8-inch nominal, APA rated sheathing, 40/20, exposure 1.
2. Floors: 3/4-inch nominal, APA rated Sturd-I-Floor, 24" o.c., exposure 1, tongue and groove.
3. Walls: 1/2-inch nominal, APA rated sheathing, 24/16, exposure 1.

D. Wood-Preservative-Treated Materials:

1. Where lumber or plywood is indicated as preservative treated or is specified to be treated, comply with applicable requirements of AWPA Standard U1. Mark each treated item with the quality mark requirements of an inspection agency approved by ALSC's Board of Review.

   a. Do not use chemicals containing chromium or arsenic.

2. Pressure treat above-ground items with waterborne preservatives to a minimum retention of 0.25 lb/cu. ft. (4.0 kg/cu. m). After treatment, kiln-dry lumber, and plywood to a maximum moisture content of 19 and 15 percent, respectively. Treat indicated items and the following:

   a. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
   b. Wood sills, sleepers, blocking, furring, stripping, and similar concealed members in contact with masonry or concrete.
   c. Wood framing members less than 18 inches (460 mm) above grade.
   d. Wood floor plates installed over concrete slabs directly in contact with earth.

3. Complete fabrication of treated items before treatment, where possible. If cut after treatment, apply field treatment complying with AWPA M4 to cut surfaces. Inspect each piece of lumber or plywood after drying and discard damaged or defective pieces.

E. Nails: Unless noted otherwise, all nails and spikes for fastening framing members together are to be common steel wire nails, conforming to ASTM F1667.

1. Where galvanized or zinc coated nails are indicated on the Drawings, provide coated nails conforming to ASTM A641.

F. Screws: Flat head conforming to ANSI/ASME Standard B18.6.1. The minimum screw bending yield strength shall conform to the wood screw values listed below the lateral design load tables in Chapter 11 of N.D.S.

G. Bolts: Conform to ASTM A307.

H. Framing Anchors: Use the products of The Simpson Strong-Tie Company, Inc. or equivalent products of other approved manufacturer.

PART 3 - EXECUTION

3.01 SURFACE CONDITIONS

A. Prior to beginning work of this Section, verify that the installed work of other trades is complete and correct to the extent necessary for the proper execution of the work of this Section.

B. In the event of discrepancies, immediately notify the Architect. Do not proceed with work affected by the discrepancies until they have been resolved.

3.02. ERECTION

A. In stud walls, attach sill plates to supporting structure with the equivalent of a 1/2-inch anchor rods at 32 inches on center, unless noted otherwise on the drawings.

B. Provide solid blocking at mid-height of stud walls.

C. Provide solid or diagonal bridging at midspan of all joists and rafters.

D. Attach all wood structural panels to supporting members per the requirements indicated on the Drawings.

3.03 ACCEPTANCE

A. Members with excessive knots, twists, checks, or shakes or other obvious imperfections, will be rejected.

END OF SECTION 06 11 00

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SECTION 06 17 13

LAMINATED VENEER LUMBER

PART 1 - GENERAL

1.01 DESCRIPTION

A. Work Included: All labor and material to furnish and install the laminated veneer lumber members shown on the Drawings and required by these Specifications.

B. Related Work Specified Elsewhere: The general provisions of the Contract apply to the work of this Section, as though reproduced herein. Carefully examine all other Sections and all Drawings for related work, which includes but is not limited to:

1.	Quality Requirements:	Section 01 40 00
2.	Structural Steel Framing:	Section 05 12 00
3.	Wood Framing:	Section 06 11 00

1.02 QUALITY ASSURANCE

A. All laminated veneer lumber construction shall conform with the governing codes including the latest adopted editions of the standards and material specifications referenced herein.

B. Reference Standards:

1. The structural design shall be based on ANSI/AWC NDS “National Design Specification for Wood Construction, by the American Wood Council.

C. Manufacturer’s Qualifications: Five years’ experience in the manufacture of products similar to those required for this project.

1.03 SUBMITTALS

A. Shop Drawings:

1. Indicate mark, number, type and location of all pieces.
2. Indicate connection details and handling instructions.

B. Submit, on request only, the manufacturer’s standard published literature and load tables.

1.04 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver lumber with setting drawings and/or installation instructions, sufficiently detailed for proper incorporation into the project.

B. Store off the ground on runners, bundled in an upright position, and protected from the weather.

C. Store and handle to avoid damage to the lumber. Replace damaged pieces.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Design, analysis, and manufacture of laminated veneer lumber shall be in accordance with ASTM D5456.

B. Member sizes indicated on the Drawings are based on the products of RedBuilt™, LLC

(formerly the Commercial Division of Trus Joist®). Material substitutions must be approved by the engineer within ten days prior to the bid date.

C. Veneers: Ultrasonically graded for consistency, to achieve allowable unit stresses of 2,500 psi in compression parallel to grain, 2,600 psi in flexural tension and compression, 285 psi in horizontal shear and 1,900 ksi in elastic modulus. Laminations to be between 1/8 inch and 1/10 inch thick.

D. Adhesive: Waterproof, conforming to ASTM D2559 and consistent with the allowable stresses listed above.

2.02 FABRICATION

A. Laminate the veneers in a continuous press, of sufficient capacity to ensure uniform distribution of the adhesive.

PART 3 - EXECUTION

3.01 SURFACE CONDITIONS

A. Prior to beginning the work of this Section, verify that the installed work of other trades is complete and correct to the extent necessary for the proper execution of the work of this Section.

B. In the event of discrepancies, immediately notify the Architect. Do not proceed with work affected by the discrepancies until they have been resolved.

3.02 ERECTION

A. DO NOT cut, notch, or otherwise modify any member except as shown on the shop drawings, for any reason.

B. Erect in strict accordance with the Drawings, and the manufacturer's instructions.

C. Assure that construction loads do not exceed the design carrying capacity of the members.

3.03 CONTRACTOR'S NOTIFICATION

A. Notify the Architect and the manufacturer immediately when a member is damaged, so that repair or replacement can be made.

B. Notify the manufacturer prior to enclosing the work of this Section, to afford the opportunity for review.

END OF SECTION 06 17 13

SECTION 06 17 53

PREFABRICATED WOOD TRUSSES

PART 1 - GENERAL

1.01 DESCRIPTION

A. Work Included: All labor and materials required to furnish and install the wood trusses shown on the drawings and as required by these Specifications. Include all bridging, bracing, blocking, anchors, extensions, etc. required for a complete installation.

B. Related Work Specified Elsewhere: The general provisions of the Contract apply to the work of this Section, as though reproduced herein. Carefully examine all other Sections and all Drawings for related work, which includes but is not limited to:

1.	Quality Requirements:	Section 01 40 00
2.	Masonry:	Division 4
3.	Structural Steel Framing:	Section 05 12 00
4.	Wood Framing:	Section 06 11 00

1.02 QUALITY ASSURANCE

A. All prefabricated wood truss construction shall conform with the governing codes including the latest adopted editions of the standards and material specifications referenced herein.

B. Reference Standards:

1. ANSI/AWC NDS “National Design Specification for Wood Construction”, by the American Wood Council.
2. ANSI/TPI-1 “National Design Standards for Metal Plate Connected Wood Truss Construction”, by the Truss Plate Institute.

C. Manufacturer’s Qualifications: Minimum three years’ experience for manufacturing comparable wood trusses.

D. Tolerances:

1. Outside Dimensions: + 1/16 inch up to 20 feet length; for greater lengths, + 1/16 inch per 20 feet length.
2. Square End Cuts: square within 1/16 inch per foot of depth and width.
3. Connector Locations: + 1/4 inch from locations shown on shop drawings.

1.03 SUBMITTALS

A. Shop Drawings:

1. Submit layout drawings indicating the mark, number, and location of all trusses. Shop Drawings submitted without layout Drawings will be immediately returned unreviewed, restarting the review process and schedule for that submittal.
2. Submit truss design and fabrication sheets sealed by a licensed professional engineer, indicating dimensioned truss profiles and all member sizes for each truss mark, including chords, webs, and connectors.
3. Indicate bridging, bearing details, anchorage, bracing, hanger connectors, etc.
4. Indicate handling instructions and erection sequence, if critical.

B. Design Analysis:

1. Submit the following for each truss: applied loads and load cases, deflections, design forces in each truss member and truss support reactions.

C. Certification: Submit, on request only, written certification that the trusses will sustain the design loads at the specified moisture content.

1.04 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Handle trusses with care, following the manufacturer's instructions.

B. Store in upright position.

C. Provide bearing supports and bracing to avoid damage from bending or overturning.

D. Protect from construction operations.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Lumber:

1. Maximum moisture content: 15%.
2. Species: Per design of the truss manufacturer.
3. Grading: Stud Grade minimum.
4. Where fire-retardant treated trusses are indicated, comply with applicable Building Code requirements and the requirements of AWPA Standard U1.

B. Metal Connector Plates (internal connections):

1. Galvanized steel sheet, ASTM A653, coating G60.
2. Manufacture with holes, plugs, teeth, or prongs uniformly spaced and formed.

C. Truss-to-Truss Hanger Connectors: Use products of the Simpson Strong-Tie Company, Inc. or equivalent.

2.02 DESIGN

A. Sizes shown on the Drawings (if any) are to be considered minimums.

B. Final design of members and connections is to be by a licensed professional engineer, registered in the state of the project, experienced in similar design, retained by the manufacturer.

C. Structural supports and loads are shown on the Structural Drawings.

D. Refer to Architectural Drawings for roof slopes, truss heel heights, workpoints, dimensions and other pertinent information regarding overall truss profiles.

E. Where truss dimensions exceed practical shipping size, trusses may be designed using "cap" trusses or "overlay" trusses. Design and detail field connections of "cap" trusses and "overlay" trusses to transfer all design forces, including anchorage against wind uplift and bracing details for any underlying, unsheathed compression chords.

PART 3 - EXECUTION

3.01 SURFACE CONDITIONS

A. Prior to beginning work of this Section, verify that the installed work of other trades is complete and correct to the extent necessary for proper execution of the work of this

Section.

B. In the event of discrepancies, immediately notify the Architect. Do not proceed with work affected by the discrepancies until they have been resolved.

3.02 ERECTION

A. Do not alter trusses in the field. Do not cut or remove truss members. Discard all trusses that do not conform to the project requirements. Replace all discarded trusses with new trusses from the truss manufacturer which conform to the project requirements.

B. Hoist trusses into position at the designated lift points.

C. Install temporary horizontal and cross bracing to keep trusses plumb and in a safe condition until permanent bracing is installed.

D. Provide and install truss hanger connectors according to the connector designations indicated on the approved shop drawings by the truss supplier. Follow the connector manufacturer's recommendations for the proper installation of all truss connectors.

E. Install permanent bracing and related components prior to application of loads to trusses.

END OF SECTION 06 17 53

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SECTION 06 20 00

FINISH CARPENTRY

PART 1 GENERAL

1.01 RELATED REQUIREMENTS

A. Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions.

B. Section 06 1000 - Rough Carpentry: Support framing, grounds, and concealed blocking.

C. Section 06 4100 - Architectural Wood Casework: Shop fabricated custom cabinet work.

D. Section 06 4200 - Wood Paneling: Shop fabricated custom paneling.

E. Section 08 1416 - Flush Wood Doors.

F. Section 08 1433 - Stile and Rail Wood Doors.

G. Section 09 9113 - Exterior Painting: Painting of finish carpentry items.

H. Section 09 9123 - Interior Painting: Painting of finish carpentry items.

I. Section 12 3530 - Residential Casework: Shop fabricated cabinet work.

1.02 REFERENCE STANDARDS

A. ANSI A135.4 - American National Standard for Basic Hardboard 2012.

B. ANSI A208.1 - American National Standard for Particleboard 2016.

C. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards 2014, with Errata (2018).

D. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards, U.S. Version 3.1 2017, with Errata (2019).

E. BHMA A156.9 - American National Standard for Cabinet Hardware 2015.

F. HPVA HP-1 - American National Standard for Hardwood and Decorative Plywood 2016.

G. PS 1 - Structural Plywood 2009.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Coordinate the work with plumbing rough-in, electrical rough-in, installation of associated and adjacent components, and [_____].

B. Sequence installation to ensure utility connections are achieved in an orderly and expeditious manner.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data:
   1. Provide instructions for attachment hardware and finish hardware.

C. Shop Drawings: Indicate materials, component profiles, fastening methods, jointing details, and accessories.

D. Samples: Submit two samples of finish plywood,_____24_x_24_ _____inch in size illustrating

wood grain and specified finish.

E. Samples: Submit two samples of wood trim 12 inch long.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Protect work from moisture damage.

PART 2 PRODUCTS

2.01 FINISH CARPENTRY ITEMS

A. Quality Grade: Unless otherwise indicated provide products of quality specified by AWI/AWMAC/WI (AWS) for Custom Paint Grade.

B. Interior Woodwork Items: (see drawings for wood species and finish)
   1. Moldings, Bases, Casings, and Miscellaneous Trim
   2. All material shall be paint grade stock.
   3. Door, Glazed Light, and Pocket Door Frames.
   4. Stairs, Balustrades, and Handrails.
   5. Loose Shelving.
   6. False Box Beams.

2.02 WOOD-BASED COMPONENTS

A. Wood fabricated from old growth timber is not permitted.

2.03 LUMBER MATERIALS

2.04 SHEET MATERIALS

A. Softwood Plywood, Not Exposed to View: Any face species, medium density fiberboard core; PS 1 Grade A-B, glue type as recommended for application.

B. Softwood Plywood, Exposed to View: Face species as indicated, plain sawn, medium density fiberboard core; PS 1 Grade A-B, glue type as recommended for application.
   1. Grading: Certified by the American Plywood Association.

C. Hardwood Plywood: Face species as indicated, plain sawn, book matched, medium density fiberboard core; HPVA HP-1 Front Face Grade AA Back Face Grade 1, glue type as recommended for application.

D. Particleboard: ANSI A208.1; Composed of wood chips, sawdust, or flakes of medium density, made with waterproof resin binders; of grade to suit application; sanded faces.

E. Hardboard: ANSI A135.4; Pressed wood fiber with resin binder, Class 1 - Tempered, 1/4 inch thick, smooth one side (S1S).

2.05 PLASTIC LAMINATE MATERIALS

A. Laminate Adhesive: Type recommended by laminate manufacturer to suit application; not containing formaldehyde or other volatile organic compounds.

2.06 FASTENINGS

A. Adhesive for Purposes Other Than Laminate Installation: Suitable for the purpose; not containing formaldehyde or other volatile organic compounds.

B. Fasteners: Of size and type to suit application; concealed.

2.07 ACCESSORIES

A. Lumber for Shimming and Blocking: Softwood lumber of similar species.

B. Primer: Alkyd primer sealer.

C. Wood Filler: Solvent base, tinted to match surface finish color.

2.08 FABRICATION

A. Shop assemble work for delivery to site, permitting passage through building openings.

B. When necessary to cut and fit on site, provide materials with ample allowance for cutting. Provide trim for scribing and site cutting.

C. Apply plastic laminate finish in full uninterrupted sheets consistent with manufactured sizes. Fit corners and joints hairline; secure with concealed fasteners. Slightly bevel arises. Locate counter butt joints minimum 2 feet from sink cut-outs.

2.09 SHOP FINISHING

A. Apply wood filler in exposed imperfections (damage as a result of construction), nail and screw indentations.

B. On items to receive transparent finishes, use wood filler that matches surrounding surfaces and is of type recommended for the applicable finish.

C. Finish work in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), Section 5 - Finishing for grade specified and as follows:
   1. Transparent:
      a. System - 1, Lacquer, Nitrocellulose.
      b. Sheen: Flat.
   2. Opaque:
      a. System - 1, Lacquer, Nitrocellulose.
      b. Color: As selected by Architect.
      c. Sheen: Flat.

D. Back prime woodwork items to be field finished, prior to installation.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify adequacy of backing and support framing.

3.02 INSTALLATION

A. Set and secure materials and components in place, plumb and level.

B. Carefully scribe work abutting other components, with maximum gaps of 1/32 inch. Do not use additional overlay trim to conceal larger gaps.

3.03 SITE APPLIED WOOD TREATMENT

A. Apply preservative treatment in accordance with manufacturer's instructions.

B. Brush apply one coats of preservative treatment on wood in contact with cementitious materials. Treat site-sawn cuts.

C. Allow preservative to dry prior to erecting members.

3.04 PREPARATION FOR SITE FINISHING

A. Set exposed fasteners. Apply wood filler in exposed fastener indentations. Sand work smooth.

B. Site Finishing: See Section 09 9113 and 09 9123.

C. Before installation, prime paint surfaces of items or assemblies to be in contact with cementitious materials.

3.05 TOLERANCES

A. Maximum Variation from True Position: 1/16 inch.

B. Maximum Offset from True Alignment with Abutting Materials: 1/32 inch.

END OF SECTION

SECTION 06 41 00

ARCHITECTURAL WOOD CASEWORK

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Specially fabricated cabinet units.

B. Hardware.

1.02 RELATED REQUIREMENTS

A. Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions.

B. Section 06 1000 - Rough Carpentry: Support framing, grounds, and concealed blocking.

C. Section 12 3600 - Countertops.

D. Section 09 9123 - Interior Painting: Field finishing of cabinet exterior.

E. Section 12 3600 - Countertops.

1.03 REFERENCE STANDARDS

A. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards 2014, with Errata (2018).

B. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards, U.S. Version 3.1 2017, with Errata (2019).

C. BHMA A156.9 - American National Standard for Cabinet Hardware 2015.

D. UL (DIR) - Online Certifications Directory Current Edition.

E. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards 2014, with Errata (2018).

F. BHMA A156.9 - American National Standard for Cabinet Hardware 2015.

G. HPVA HP-1 - American National Standard for Hardwood and Decorative Plywood 2016.

H. NEMA LD 3 - High-Pressure Decorative Laminates 2005.

I. WI (CCP) - Certified Compliance Program (CCP) Current Edition.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate materials, component profiles, fastening methods, jointing details, and accessories.

C. Product Data: Provide data for hardware accessories.

D. Samples: Submit actual samples of architectural cabinet construction, minimum 12 inches square, illustrating proposed cabinet, countertop, and shelf unit substrate and finish.

E. Samples: Submit actual sample items of proposed pulls, hinges, shelf standards, and locksets, demonstrating hardware design, quality, and finish.

1.05 QUALITY ASSURANCE

A. Fabricator Qualifications: Company specializing in fabricating the products specified in this section with minimum five years of documented experience.
   1. Company with at least one project in the past 5 years with value of woodwork within 20 percent of cost of woodwork for this Project.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Protect units from moisture damage.

1.07 FIELD CONDITIONS

A. During and after installation of custom cabinets, maintain temperature and humidity conditions in building spaces at same levels planned for occupancy.

PART 2 PRODUCTS

2.01 CABINETS

A. Quality Standard: Custom Grade, in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), unless noted otherwise.

B. Wood Veneer Faced Cabinet:

C. Plastic Laminate Faced Cabinets: Custom grade.

D. Cabinetsat Common Area custom cabinetry:
   1. Finish - Exposed Exterior Surfaces: Wood.
   2. Finish - Concealed Surfaces: Manufacturer's option.
   3. Door and Drawer Front Style : Square edge flat panel..
   4. Casework Construction Type: Type B - Face-frame.
   5. Interface Style for Cabinet and Door: Style 1 - Overlay; Full Overlay.
   6. Cabinet Style: Flush overlay.
   7. Cabinet Doors and Drawer Fronts: Flush style.
   8. Drawer Side Construction: Multiple-dovetailed.
   9. Drawer Construction Technique: Dovetail joints.

2.02 WOOD-BASED COMPONENTS

A. Wood fabricated from old growth timber is not permitted.

2.03 COUNTERTOPS

A. Countertops are specified in Section 12 3600.

2.04 ACCESSORIES

A. Adhesive: Type recommended by fabricator to suit application.
   1. Manufacturers:
      a. Franklin International, Inc; Titebond Original Wood Glue: www.titebond.com/#sle.
      b. Substitutions: See Section 01 6000 - Product Requirements.

B. Plastic Edge Banding: Extruded PVC, convex shaped; smooth finish; self locking serrated tongue; of width to match component thickness.
   1. Color: As selected by Architect from manufacturer's standard range.
   2. Use at all exposed plywood edges.
   3. Use at all exposed shelf edges.

C. Concealed Joint Fasteners: Threaded steel.

D. Grommets: Standard plastic, painted metal, or rubber grommets for cut-outs, in color to match adjacent surface.

2.05 HARDWARE

A. Hardware: BHMA A156.9, types as recommended by fabricator for quality grade specified.

B. Adjustable Shelf Supports: Standard side-mounted system using recessed metal shelf standards or multiple holes for pin supports and coordinated self rests, polished chrome finish, for nominal 1 inch spacing adjustments.

C. Adjustable Shelf Supports: Standard back-mounted system using surface mounted metal shelf standards and coordinated cantilevered shelf brackets, satin chrome finish, for nominal 1 inch spacing adjustments.

D. Drawer and Door Pulls: "U" shaped wire pull, steel with satin finish, 4 inch centers.

E. Cabinet Locks: Keyed cylinder, two keys per lock, master keyed, steel with chrome finish. At all common area cabinets.

F. Catches: Magnetic.

G. Drawer Slides:
   1. Type: Extension types as indicated.
   2. Static Load Capacity: Commercial grade.
   3. Mounting: Side mounted.
   4. Stops: Integral type.
   5. Manufacturers:
      a. Accuride International, Inc: www.accuride.com/#sle.
      b. Grass America Inc: www.grassusa.com.
      c. Hettich America, LP: www.hettich.com/#sle.
      d. Knape & Vogt Manufacturing Company: www.knapeandvogt.com/#sle.
      e. Substitutions: See Section 01 6000 - Product Requirements.

H. Hinges: European style concealed self-closing type, steel with polished finish.
   1. Manufacturers:
      a. Grass America Inc; Tiomos Hinge System: www.grassusa.com/#sle.
      b. Hardware Resources: www.hardwareresources.com/#sle.
      c. Hettich America, LP: www.hettich.com/#sle.
      d. Blum, Inc: www.blum.com/#sle.
      e. Substitutions: See Section 01 6000 - Product Requirements.

2.06 SHOP TREATMENT OF WOOD MATERIALS

A. Provide UL (DIR) listed and approved identification on fire retardant treated material.

2.07 SITE FINISHING MATERIALS

A. Stain, Shellac, Varnish, and Finishing Materials: In compliance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), unless noted otherwise.

2.08 FABRICATION

A. Assembly: Shop assemble cabinets for delivery to site in units easily handled and to permit passage through building openings.

B. Edging: Fit shelves, doors, and exposed edges with specified edging. Do not use more than one piece for any single length.

C. Fitting: When necessary to cut and fit on site, provide materials with ample allowance for cutting. Provide matching trim for scribing and site cutting.

D. Plastic Laminate: Apply plastic laminate finish in full uninterrupted sheets consistent with manufactured sizes. Fit corners and joints hairline; secure with concealed fasteners. Slightly bevel arises. Locate counter butt joints minimum 2 feet from sink cut-outs.
   1. Cap exposed plastic laminate finish edges with material of same finish and pattern.

E. Matching Wood Grain: Comply with requirements of quality standard for specified Grade and as follows:
   1. Provide center matched panels at each elevation.

F. Provide cutouts for plumbing fixtures. Verify locations of cutouts from on-site dimensions. Prime paint cut edges.

2.09 SHOP FINISHING

A. Sand work smooth and set exposed nails and screws.

B. For opaque finishes, apply wood filler in exposed nail and screw indentations and sand smooth.

C. On items to receive transparent finishes, use wood filler matching or blending with surrounding surfaces and of types recommended for applied finishes.

D. Finish work in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), Section 5 - Finishing for grade specified and as follows:
   1. Transparent:
      a. Stain: As selected by Architect.
      b. Sheen: Flat.
   2. Opaque: (where indicated)
      a. System - 1, Lacquer, Nitrocellulose.
      b. Color: As selected by Architect.
      c. Sheen: Flat.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify adequacy of backing and support framing.

B. Verify field measurements.

3.02 INSTALLATION

A. Set and secure custom cabinets in place, assuring that they are rigid, plumb, and level.

B. Use fixture attachments in concealed locations for wall mounted components.

C. Use concealed joint fasteners to align and secure adjoining cabinet units.

D. Carefully scribe casework abutting other components, with maximum gaps of 1/32 inch. Do not use additional overlay trim for this purpose.

E. Secure cabinets to floor using appropriate angles and anchorages.

F. Countersink anchorage devices at exposed locations. Conceal with solid wood plugs of species to match surrounding wood; finish flush with surrounding surfaces.

3.03 ADJUSTING

A. Adjust installed work.

B. Adjust moving or operating parts to function smoothly and correctly.

3.04 CLEANING

A. Clean casework, counters, shelves, hardware, fittings, and fixtures.

END OF SECTION

SECTION 06 83 16

FIBERGLASS REINFORCED PANELING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fiberglass reinforced plastic panels.

1.02 REFERENCE STANDARDS

A. ASTM D256 - Standard Test Methods for Determining the Izod Pendulum Impact Resistance of Plastics 2010 (Reapproved 2018).

B. ASTM D2583 - Standard Test Method for Indentation Hardness of Rigid Plastics by Means of Barcol Impressor 2013a.

C. ASTM D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber 2016.

D. ASTM D5319 - Standard Specification for Glass-Fiber Reinforced Polyester Wall and Ceiling Panels 2017.

E. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2020.

F. FDA Food Code - Chapter 6 - Physical Facilities Current Edition.

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Samples: Submit two samples 6 by 6" inch in size illustrating material and surface design of panels.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Store panels flat, indoors, on a clean, dry surface. Remove packaging and allow panels to acclimate to room temperature for 48 hours prior to installation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Glass Fiber Reinforced Plastic Panels: A. Basis-of-Design Product: Subject to compliance with requirements, provide Marlite Standard FRP

2.02 PANEL SYSTEMS

A. Wall Panels:
   1. Panel Size: 4 by 8 feet.
   2. Panel Thickness: 0.10 inch.
   3. Surface Design: Embossed.
   4. Attachment Method: Adhesive only, sealant joints, no trim.

2.03 MATERIALS

A. Panels: Fiberglass reinforced plastic (FRP), complying with ASTM D5319.
   1. Surface Burning Characteristics: Maximum flame spread index of 25 and smoke developed index of 450; when system tested in accordance with ASTM E84.

2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
3. Scratch Resistance: Barcol hardness score greater than 35, when tested in accordance with ASTM D2583.
4. Impact Strength: Greater than 6 ft lb force per inch, when tested in accordance with ASTM D256.
5. Surface Characteristics and Cleanability: Provide products that are smooth, durable, and easily cleanable, in compliance with FDA Food Code, Chapter 6 - Physical Facilities.

B. Sealant: Type recommended by panel manufacturer; white.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions and substrate flatness before starting work.

B. Verify that substrate conditions are ready to receive the work of this section.

3.02 INSTALLATION - WALLS

A. Install panels in accordance with manufacturer's instructions.

B. Cut and drill panels with carbide tipped saw blades, drill bits, or snips.

C. Apply adhesive to the back side of the panel using trowel as recommended by adhesive manufacturer.

D. Apply panels to wall with seams plumb and pattern aligned with adjoining panels.

E. Install panels with manufacturer's recommended gap for panel field and corner joints.

F. Seal gaps at floor, ceiling, and between panels with applicable sealant to prevent moisture intrusion.

G. Remove excess sealant after paneling is installed and prior to curing.

END OF ECTION

SECTION 07 13 00

SHEET WATERPROOFING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Sheet Waterproofing:
   1. EPDM rubber sheet membrane.

B. Below-grade waterproofing accessories.

1.02 RELATED REQUIREMENTS

A. Section 03 3000 - Cast-in-Place Concrete: Concrete substrate.

B. Section 07 6200 - Sheet Metal Flashing and Trim: Metal parapet, coping, and counterflashing.

C. Section 07 9200 - Joint Sealants: Sealing moving joints in waterproofed surfaces that are not required to be treated in this section.

D. Section 22 1006 - Plumbing Piping Specialties: Roof drain and plumbing vent flashing flanges.

1.03 REFERENCE STANDARDS

A. ASTM D412 - Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers--Tension 2016.

B. ASTM D570 - Standard Test Method for Water Absorption of Plastics 1998 (Reapproved 2018).

C. ASTM D624 - Standard Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomers 2000 (Reapproved 2020).

D. ASTM D746 - Standard Test Method for Brittleness Temperature of Plastics and Elastomers by Impact 2020.

E. ASTM D882 - Standard Test Method for Tensile Properties of Thin Plastic Sheeting 2018.

F. ASTM D903 - Standard Test Method for Peel or Stripping Strength of Adhesive Bonds 1998 (Reapproved 2017).

G. ASTM D1621 - Standard Test Method for Compressive Properties Of Rigid Cellular Plastics 2016.

H. ASTM D1876 - Standard Test Method for Peel Resistance of Adhesives (T-Peel Test) 2008, with Editorial Revision (2015).

I. ASTM D1970/D1970M - Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection 2019.

J. ASTM D2240 - Standard Test Method for Rubber Property--Durometer Hardness 2015, with Editorial Revision (2017).

K. ASTM D4551 - Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Flexible Concealed Water-Containment Membrane 2017.

L. ASTM D4637/D4637M - Standard Specification for EPDM Sheet Used in Single-Ply Roof Membrane 2015.

M. ASTM D5295/D5295M - Standard Guide for Preparation of Concrete Surfaces for Adhered (Bonded) Membrane Waterproofing Systems 2018.

N. ASTM D5385/D5385M - Standard Test Method for Hydrostatic Pressure Resistance of Waterproofing Membranes 1993, with Editorial Revision (2014).

O. ASTM D6134 - Standard Specification for Vulcanized Rubber Sheets Used in Waterproofing Systems 2007 (Reapproved 2019).

P. ASTM D6506 - Standard Specification for Asphalt Based Protection for Below-Grade Waterproofing 2001 (Reapproved 2009).

Q. ASTM E154/E154M - Standard Test Methods for Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs, on Walls, or as Ground Cover 2008a, with Editorial Revision (2013).

R. NRCA (WM) - The NRCA Waterproofing Manual 2005.

S. NRCA ML104 - The NRCA Roofing and Waterproofing Manual Fifth Edition, with interim updates.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data for membrane.

C. Shop Drawings: Indicate special joint or termination conditions and conditions of interface with other materials.

D. Certificate: Certify that products meet or exceed specified requirements.

E. Manufacturer's Installation Instructions: Indicate special procedures.

F. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.05 QUALITY ASSURANCE

A. Perform Work in accordance with NRCA Roofing and Waterproofing Manual for sheet membrane waterproofing system.

B. Membrane Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience.

C. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.

1.06 FIELD CONDITIONS

A. Maintain ambient temperatures above 40 degrees F for 24 hours before and during application and until liquid or mastic accessories have cured.

1.07 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Contractor shall correct defective Work within a five year period after Date of Substantial Completion; remove and replace materials concealing waterproofing at no extra cost to Owner.

PART 2 PRODUCTS

2.01 WATERPROOFING APPLICATIONS

A. EPDM Rubber Sheet Membrane:
   1. Location: [_____].
   2. Vertical Surfaces: Adhesive bonded to substrate.
   3. Horizontal Surfaces: Adhesive bonded to substrate.
   4. Cover with protection board.

2.02 MEMBRANE MATERIALS

A. EPDM Rubber Sheet Membrane: Complies with ASTM D4637/D4637M, Type I unreinforced and with soil burial resistance requirement of ASTM D6134.
   1. Thickness: 0.060 inch, minimum.
   2. Sheet Width: As large as is practical, with factory vulcanized splices.
   3. Field Seaming: Contact cement and lap edge sealant.
   4. Adhesives, Sealants, Tapes, and Accessories: As recommended by membrane manufacturer.
   5. Flashing: Cured EPDM rubber sheet.
   6. Manufacturers:
      a. Carlisle Coatings & Waterproofing Inc; Sure-Seal EPDM Membrane: www.carlisleccw.com/#sle.
      b. Substitutions: See Section 01 6000 - Product Requirements.

2.03 ACCESSORIES

A. Sealant for Cracks and Joints In Substrates: Resilient elastomeric joint sealant compatible with substrates and waterproofing materials.

B. Protection Board: Type capable of preventing damage to waterproofing due to backfilling and construction traffic.
   1. Use one of the following:
      a. Asphalt impregnated wood fiberboard, 1/4 inch thick.
      b. Polystyrene foam board, 1 inch thick.
      c. Multi-layer internally-reinforced asphaltic panels, 1/8 inch thick, nominal, complying with ASTM D6506.

C. Flexible Flashings: Type recommended by membrane manufacturer.

D. Counterflashings: [___] as specified in Section 07 6200.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions are acceptable prior to starting this work.

B. Verify substrate surfaces are durable; free of matter detrimental to adhesion or application of waterproofing system.

C. Verify items that penetrate surfaces to receive waterproofing are securely installed.

3.02 PREPARATION

A. Protect adjacent surfaces from damage not designated to receive waterproofing.

B. Clean and prepare surfaces to receive waterproofing in accordance with manufacturer's instructions; vacuum substrate clean.

C. Do not apply waterproofing to surfaces unacceptable to membrane manufacturer.

D. Seal cracks and joints with sealant using depth to width ratio as recommended by sealant manufacturer.

E. Surfaces for Adhesive Bonding: Apply surface conditioner at a rate recommended by manufacturer, and protect conditioner from rain or frost until dry.

F. Concrete Surfaces for Adhesive Bonding: Prepare concrete substrate according to ASTM D5295/D5295M.
   1. Remove substances that inhibit adhesion including form release agents, curing compounds admixtures, laitance, moisture, dust, dirt, grease and oil.
   2. Repair surface defects including honeycombs, fins, tie holes, bug holes, sharp offsets, rutted cracks, ragged corners, deviations in surface plane, spalling and delaminations, as described in the reference standard.
   3. Remove and replace areas of defective concrete as specified in Section 03 3000.
   4. Prepare concrete for adhesive bonded waterproofing using mechanical or chemical methods described in the referenced standard.
   5. Test concrete surfaces as described in the referenced standards. Verify surfaces are ready to receive adhesive bonded waterproofing membrane system.

3.03 INSTALLATION - MEMBRANE

A. Install membrane waterproofing in accordance with manufacturer's instructions and NRCA (WM) applicable requirements.

B. Roll out membrane, and minimize wrinkles and bubbles.

C. Self-Adhering Membrane: Remove release paper layer, and roll out onto substrate with a mechanical roller to provide full contact bond.

D. Overlap edges and ends, minimum 3 inches, seal permanently waterproof by method recommended by manufacturer, and apply uniform bead of sealant to joint edge.

E. Reinforce membrane with multiple thickness of membrane material over joints, whether joints are static or dynamic.

F. Weather lap joints on sloped substrate in direction of drainage, and seal joints and seams.

G. Flexible Flashings: Seal items watertight that penetrate through waterproofing membrane with flexible flashings.

H. Seal membrane and flashings to adjoining surfaces.

3.04 INSTALLATION - DRAINAGE PANEL AND PROTECTION BOARD

A. Place protection board directly against drainage panel; butt joints. Scribe and cut boards around projections, penetrations, and interruptions.

B. Adhere protection board to substrate with compatible adhesive.

3.05 FIELD QUALITY CONTROL

A. Upon completion of horizontal membrane installation, dam installation area in preparation for flood testing.

B. Flood to minimum depth of 1 inch with clean water, and after 48 hours inspect for leaks.

C. If leaking is found, remove water, repair leaking areas with new waterproofing materials as directed by Architect; repeat flood test, and repair damage to building.

D. When area is proven watertight, drain water and remove dam.

3.06 PROTECTION

A. Do not permit traffic over unprotected or uncovered membrane.

END OF SECTION

SECTION 07 19 00

WATER REPELLENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Water repellents applied to exterior and interior, masonry, stone, and concrete surfaces.

B. Water repellents applied to exerior concrete masonry surfaces.

C. Pressure washing.

1.02 RELATED REQUIREMENTS

A. Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions.

B. Section 07 9005 - Joint Sealers.

1.03 REFERENCE STANDARDS

A. ASTM C140/C140M - Standard Test Methods for Sampling and Testing Concrete Masonry Units and Related Units 2020a.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide product description.

C. Manufacturer's Installation Instructions: Indicate special procedures and conditions requiring special attention; cautionary procedures required during application.

D. Manufacturer's Qualification Statement.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years documented experience.

1.06 MOCK-UP

A. Prepare a representative surface _48"_____by _48"_____inch in size using specified materials and preparation and application methods on surfaces identical to those to be coated; approved mock-up constitutes standard for workmanship.

B. Locate where directed.

C. Mock-up may remain as part of the Work.

1.07 FIELD CONDITIONS

A. Protect liquid materials from freezing.

B. Do not apply water repellent when ambient temperature is lower than 50 degrees F or higher than 100 degrees F.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Silane, Siloxane, Silane-Siloxane Blend, and Siliconate Water Repellents:
   1. Tnemec Company, Inc: www.tnemec.com.
   2. BASF Construction Chemicals: www.buildingsystems.basf.com.
   3. The QUIKRETE Companies; QUIKRETE® Concrete & Masonry Waterproofing Sealer: www.quikrete.com.
   4. Sherwin-Williams Company: www.sherwin-williams.com.
   5. Pecora Corporation: www.pecora.com.
   6. PROSOCO, Inc: www.prosoco.com.

2.02 MATERIALS

A. Water Repellent: Non-glossy, colorless, penetrating, water-vapor-permeable, non- yellowing sealer, that dries invisibly leaving appearance of substrate unchanged.
   1. Applications: Vertical surfaces and non-traffic horizontal surfaces.
   2. Number of Coats: Two.
   3. Products: Silane, siloxane, silane-siloxane blend, or siliconate that reacts chemically with concrete and masonry; minimum 90 percent nonvolatile content.
      a. Advanced Chemical Technologies, Inc; SIL-ACT ATS-100. [VOC < 350 g/L]
      b. Dayton Superior Corporation; Weather Worker 100% J29A . [VOC < 228 g/L].
      c. Pecora Corporation; [___].
      d. PROSOCO, Inc; Consolideck SL100 Water Repellent. [VOC < 400 g/L]
      e. Substitutions: See Section 01 6000 - Product Requirements.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify joint sealants are installed and cured.

C. Verify surfaces to be coated are dry, clean, and free of efflorescence, oil, or other matter detrimental to application of water repellent.

3.02 PREPARATION

A. Protection of Adjacent Work:
   1. Protect adjacent landscaping, property, and vehicles from drips and overspray.
   2. Protect adjacent surfaces not intended to receive water repellent.

B. Prepare surfaces to be coated as recommended by water repellent manufacturer for best results.

C. Do not start work until masonry mortar substrate is cured a minimum of 60 days.

D. Remove loose particles and foreign matter.

E. Remove oil and foreign substances with a chemical solvent that will not affect water repellent.

F. Allow surfaces to dry completely to degree recommended by water repellent manufacturer before starting coating work.

3.03 APPLICATION

A. Apply water repellent in accordance with manufacturer's instructions, using

procedures and application methods recommended as producing the best results.

B. Apply at rate recommended by manufacturer, continuously over entire surface.

C. Apply two coats, minimum.

D. Remove water repellent from unintended surfaces immediately by a method instructed by water repellent manufacturer.

END OF SECTION

SECTION 07 2100

THERMAL INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Board insulation and integral vapor retarder at cavity wall construction, perimeter foundation wall, underside of floor slabs, over roof deck, over roof sheathing, and exterior wall behind gypsum board wall finish.

B. Batt insulation and vapor retarder in exterior wall, ceiling, and roof construction.

C. Batt insulation for filling perimeter window and door shim spaces and crevices in exterior wall and roof.

D. Batt insulation in interior wall construction.

1.02 RELATED REQUIREMENTS

A. Section 03 3000 - Cast-in-Place Concrete: Field-applied termiticide for concrete slabs and foundations.

B. Section 05 4000 - Cold-Formed Metal Framing: Board insulation as wall sheathing.

C. Section 06 0573 - Wood Treatment: Field-applied termiticide for wood.

D. Section 06 1000 - Rough Carpentry: Supporting construction for batt insulation.

E. Section 07 2126 - Blown Insulation: Blown-in, gravity-held fibrous insulation.

F. Section 07 2500 - WEATHER BARRIERS: Separate air barrier and vapor retarder materials.

G. Section 07 8400 - Firestopping: Insulation as part of fire-rated through-penetration assemblies.

H. Section 09 2116 - Gypsum Board Assemblies: Acoustic insulation inside walls and partitions.

1.03 REFERENCE STANDARDS

A. ASTM C240 - Standard Test Methods for Testing Cellular Glass Insulation Block 2020.

B. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus 2017.

C. ASTM C552 - Standard Specification for Cellular Glass Thermal Insulation 2017, with Editorial Revision (2018).

D. ASTM C553 - Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications 2013 (Reapproved 2019).

E. ASTM C578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation 2019.

F. ASTM C612 - Standard Specification for Mineral Fiber Block and Board Thermal Insulation 2014 (Reapproved 2019).

G. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal

Insulation for Light Frame Construction and Manufactured Housing 2017.

H. ASTM C1289 - Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board 2019.

I. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2020.

J. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials 2016.

K. ASTM E136 - Standard Test Method for Assessing Combustibility of Materials Using a Vertical Tube Furnace at 750°C 2019a.

L. NFPA 285 - Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Non-Load-Bearing Wall Assemblies Containing Combustible Components 2019.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on product characteristics, performance criteria, and product limitations.

C. Manufacturer's Installation Instructions: Include information on special environmental conditions required for installation and installation techniques.

1.05 FIELD CONDITIONS

A. Do not install insulation adhesives when temperature or weather conditions are detrimental to successful installation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

2.02 APPLICATIONS

A. Insulation Under Concrete Slabs: Extruded polystyrene (XPS) board.

B. Insulation at Perimeter of Foundation: Extruded polystyrene (XPS) board.

C. Insulation in Wood Framed Walls: Batt insulation with separate vapor retarder.

D. Insulation Above Lay-In Acoustical Ceilings: Batt insulation with no vapor retarder.

E. Insulation Over Roof Deck: Extruded polystyrene (XPS) board.

F. Insulation in Interior Wood Frame Walls: Batt Insulation

2.03 FOAM BOARD INSULATION MATERIALS

A. Extruded Polystyrene (XPS) Board Insulation: Complies with ASTM C578 with either natural skin or cut cell surfaces.
   1. Type and Compressive Resistance: Type IV, 25 psi (173 kPa), minimum.
   2. Flame Spread Index (FSI): Class B - 26 to 75, when tested in accordance with ASTM E84.
   3. Smoke Developed Index (SDI): 450 or less, when tested in accordance with ASTM E84.
   4. Type and Thermal Resistance, R-value: Type IV, 5.0 (0.88) per 1 inch thickness at 75 degrees F mean temperature.
   5. R-value; 1 inch of material at 72 degrees F: 5, minimum.
   6. Complies with fire resistance requirements shown on the drawings as part of an exterior non-load-bearing exterior wall assembly when tested in accordance with NFPA 285.

7. Board Thickness: 1-1/2 inches.
8. Board Edges: Square.
9. Type and Water Absorption: Type IV, 0.3 percent by volume, maximum, by total immersion.
10. Manufacturers:
    a. Dow Chemical Company; [___]: www.dow.com.
    b. Owens Corning Corp: www.owenscorning.com.
    c. Kingspan Insulation LLC; GreenGuard XPS TYPE IV 25 PSI: www.trustgreenguard.com/#sle.
    d. Owens Corning Corporation; FOAMULAR Extruded Polystyrene (XPS) Insulation: www.ocbuildingspec.com/#sle.

B. Polyisocyanurate (ISO) Board Insulation: Rigid cellular foam, complying with ASTM C1289.

1. Classifications:
    a. Type II:
        1) Class 1 - Faced with glass fiber reinforced cellulosic felt facers on both major surfaces of core foam.
        2) Compressive Strength: Classes 1-2-3, Grade 1 - 16 psi (110 kPa), minimum.
        3) Thermal Resistance, R-value: At 1-1/2 inch thick; Class 1, Grades 1-2-3
        - 8.4 (1.48) at 75 degrees F.
2. Flame Spread Index (FSI): Class A - 0 to 25, when tested in accordance with ASTM E84.
3. Smoke Developed Index (SDI): 450 or less, when tested in accordance with ASTM E84.
4. Water Vapor Permeance: 1.2 perm, maximum, at 1 inch thickness, and when tested in accordance with ASTM E96/E96M, desiccant method.
5. Complies with fire resistance requirements indicated on drawings as part of an exterior non-load-bearing exterior wall assembly when tested in accordance with NFPA 285.
6. Board Size: 48 inch by 96 inch.
7. Board Thickness: 1.5 inch.
8. Tapered Board: Slope as indicated; minimum thickness [__] inch; fabricate of fewest layers possible.
9. Board Edges: Square.
10. Manufacturers:
    a. Atlas Roofing Corporation; ACFoam-II Polyiso Roof Insulation: www.atlasroofing.com/#sle.
    b. Carlisle Coatings & Waterproofing, Inc; R2+ Matte: www.carlisleccw.com/#sle.
    c. GAF; EnergyGuard Polyiso Insulation: www.gaf.com/#sle.

2.04 BATT INSULATION MATERIALS

A. Where batt insulation is indicated, either glass fiber or mineral fiber batt insulation may be used, at Contractor's option; unless specifically indicated one or the other.

B. Glass Fiber Batt Insulation: Flexible preformed batt or blanket, complying with ASTM C665; friction fit.

1. Flame Spread Index: 25 or less, when tested in accordance with ASTM

E84.
2. Smoke Developed Index: 450 or less, when tested in accordance with ASTM E84.
3. Combustibility: Non-combustible, when tested in accordance with ASTM E136, except for facing, if any.
4. Formaldehyde Content: Zero.
5. Facing: Unfaced.
6. Manufacturers:
   a. CertainTeed Corporation; [___]: www.certainteed.com/#sle.
   b. Johns Manville; [____]: www.jm.com/#sle.
   c. Owens Corning Corp: www.owenscorning.com.
7. Substitutions: See Section 01 6000 - Product Requirements.

C. Mineral Fiber Batt Insulation: Flexible or semi-rigid preformed batt or blanket, complying with ASTM C665; friction fit; unfaced flame spread index of 0 (zero) when tested in accordance with ASTM E84.
1. Flame Spread Index: 25 or less, when tested in accordance with ASTM E84.
2. Smoke Developed Index: 0 (zero), when tested in accordance with ASTM E84.
3. Manufacturers:
   a. Johns Manville; MinWool Sound Attenuation Fire Batts: www.jm.com/#sle.
   b. Knauf Insulation; EcoBatt Insulation: www.knaufinsulation.com/#sle.
   c. Thermafiber, Inc; SAFB: www.thermafiber.com.
   d. ROCKWOOL (ROXUL, Inc); COMFORTBATT: www.rockwool.com/#sle.
   e. ROCKWOOL (ROXUL, Inc); AFB evo™: www.rockwool.com/#sle.
   f. Substitutions: See Section 01 6000 - Product Requirements.

2.05 ACCESSORIES

A. Sheet Vapor Retarder: Specified in Section 07 2500.

B. Tape: Bright aluminum self-adhering type, mesh reinforced, 2 inch wide.

C. Insulation Fasteners: Impaling clip of unfinished steel with washer retainer and clips, to be adhered to surface to receive insulation, length to suit insulation thickness and substrate, capable of securely and rigidly fastening insulation in place.

D. Nails or Staples: Steel wire; electroplated or galvanized; type and size to suit application.

E. Adhesive: Type recommended by insulation manufacturer for application.

F. Spray foam insulation: Non-expanded foam spray for application into cracks around exterior doors and windows, closely spaced framing members, holes and penetrations.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrate, adjacent materials, and insulation materials are dry and that substrates are ready to receive insulation.

B. Verify substrate surfaces are flat, free of honeycomb, fins, irregularities, or materials or substances that may impede adhesive bond.

3.02 GENERAL

A. Provide complete insulation package for proposed structure including foundation, walls, floors, attics and any assembly exposed to the exterior.

B. Insulate all crevices at exterior openings and penetrations either with batt insulation or non expanding foam.

C. Fill all holes in top and bottom wall plates of attics and crawl spaces with nonexpanding foam.

3.03 BOARD INSTALLATION AT EXTERIOR WALLS

A. Install boards horizontally on walls.

B. Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.

3.04 BOARD INSTALLATION AT CAVITY WALLS

A. Install boards to fit snugly between wall ties.

B. Install boards horizontally on walls.

C. Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.

3.05 BOARD INSTALLATION UNDER CONCRETE SLABS

A. Place insulation under slabs on grade after base for slab has been compacted.

B. Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.

C. Prevent insulation from being displaced or damaged while placing vapor retarder and placing slab.

3.06 BOARD INSTALLATION OVER LOW SLOPE ROOF DECK

A. Board Installation Over Roof Deck, General:
   1. See applicable roofing specification section for specific board installation requirements.
   2. Fasten insulation to deck in accordance with roofing manufacturer's written instructions and applicable Factory Mutual requirements.
   3. Do not apply more insulation than can be covered with roofing on the same day.

3.07 BATT INSTALLATION

A. Install insulation and vapor retarder in accordance with manufacturer's instructions.

B. Install in exterior wall and roof spaces without gaps or voids. Do not compress insulation.

C. Trim insulation neatly to fit spaces. Insulate miscellaneous gaps and voids.

D. Fit insulation tightly in cavities and tightly to exterior side of mechanical and electrical services within the plane of the insulation.

E. At wood framing, place vapor retarder on warm side of insulation by stapling at 6 inches on center. Lap and seal sheet retarder joints over member face.

F. At metal framing, place vapor retarder on warm side of insulation; lap and seal sheet retarder joints over member face.

G. Tape seal tears or cuts in vapor retarder.

H. Extend vapor retarder tightly to full perimeter of adjacent window and door frames and other items interrupting the plane of the membrane. Tape seal in

place.

3.08 PROTECTION

A. Do not permit installed insulation to be damaged prior to its concealment.

END OF SECTION

SECTION 07 21 19

FOAMED-IN-PLACE INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Foamed-in-place insulation.
   1. In exterior framed walls.

1.02 REFERENCE STANDARDS

A. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus 2017.

B. ASTM D2842 - Standard Test Method for Water Absorption of Rigid Cellular Plastics 2019.

C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2020.

D. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials 2016.

E. ASTM E283 - Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen 2004 (Reapproved 2012).

F. ASTM E2178 - Standard Test Method for Air Permeance of Building Materials 2013.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene one week prior to commencing work of this section.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Manufacturer Qualification: Submit documentation of current evaluation of proposed manufacturer and materials.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products of the type specified in this section, with not less than three years of documented experience.

B. Applicator Qualifications: Company specializing in performing work of the type specified, with minimum three years documented experience.

1.06 FIELD CONDITIONS

A. Do not apply foam when temperature is below that specified by the manufacturer for ambient air and substrate.

B. Do not apply foam when temperature is within 5 degrees F of dew point.

PART 2 PRODUCTS

2.01 MATERIALS

A. Foamed-In-Place Insulation: Medium-density, rigid or semi-rigid, open or closed cell polyurethane foam; foamed on-site, using blowing agent of water or non-ozone- depleting gas.
   1. Thermal Resistance: R-value of 5.0, minimum, per 1 inch thickness at 75 degrees F mean temperature when tested in accordance with ASTM C518.
   2. Water Vapor Permeance: Vapor retarder; 2 perms, maximum, when tested at intended thickness in accordance with ASTM E96/E96M, desiccant method.
   3. Water Absorption: Less than 2 percent by volume, maximum, when tested in accordance with ASTM D2842.
   4. Air Permeance: 0.04 cfm/sq ft, maximum, when tested at intended thickness in accordance with ASTM E2178 or ASTM E283 at 1.57 psf.
   5. Closed Cell Content: At least 90 percent.
   6. Surface Burning Characteristics: Flame spread/Smoke developed index of 25/450, maximum, when tested in accordance with ASTM E84.
   7. Basis of Design:
      a. Icynene-Lapolla; Icynene ProSeal LE: www.icynene.com/#sle.
   8. Other Acceptable Manufacturers:
      a. BASF Corporation; SPRAYTITE 158: www.spf.basf.com/#sle.
      b. Johns Manville; JM Corbond MCS Closed Cell Spray Polyurethane Foam: www.jm.com/#sle.
   9. Substitutions: See Section 01 6000 - Product Requirements.

2.02 ACCESSORIES

A. Primer: As required by insulation manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify work within construction spaces or crevices is complete prior to insulation application.

B. Verify that surfaces are clean, dry, and free of matter that may inhibit insulation or overcoat adhesion.

3.02 PREPARATION

A. Mask and protect adjacent surfaces from over spray or dusting.

B. Apply primer in accordance with manufacturer's instructions.

3.03 APPLICATION

A. Apply insulation in accordance with manufacturer's instructions.

3.04 FIELD QUALITY CONTROL

A. Field inspections and tests will be performed by an independent testing agency under provisions of Section 01 4000 - Quality Requirements.

3.05 PROTECTION

A. Do not permit subsequent construction work to disturb applied insulation.

END OF SECTION

SECTION 07 2126

BLOWN INSULATION

PART 1 GENERAL

1.01 REFERENCE STANDARDS

A. ASTM C739 - Standard Specification for Cellulosic Fiber Loose-Fill Thermal Insulation 2017.

B. ASTM C1015 - Standard Practice for Installation of Cellulosic and Mineral Fiber Loose- Fill Thermal Insulation 2017.

1.02 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on product characteristics, performance criteria, and limitations.

C. Manufacturer's Installation Instructions: Indicate procedure for preparation and installation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Blown Insulation:
   1. CertainTeed Corporation: www.certainteed.com.
   2. GreenFiber: www.greenfiber.com.
   3. Johns Manville: www.jm.com.

2.02 MATERIALS

A. Applications: Provide blown insulation in attic, exterior walls, and ceiling as indicated on drawings.

B. Loose Fill Insulation: ASTM C739, cellulose fiber type, bulk for pneumatic placement.
   1. Thermal Transmittance (U-value): 0.27 BTU/hr sq ft deg F, maximum.
   2. Installed Thickness: As indicated on drawings to achieve required R Value indicated.

C. Ventilation Baffles: Formed plastic.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrate and adjacent materials are dry and ready to receive insulation.

B. Verify that light fixtures have thermal cut-out device to restrict over-heating in soffit or ceiling spaces.

C. Verify spaces are unobstructed to allow for proper placement of insulation.

3.02 INSTALLATION

A. Install insulation and ventilation baffle in accordance with ASTM C1015 and manufacturer's instructions.

B. Place insulation against baffles, and do not impede natural attic ventilation to soffit.

C. Completely fill intended spaces leaving no gaps or voids.

D. Repair and reseal insulation access ports, and refinish to match adjacent work.

3.03 CLEANING

A. Remove loose insulation residue.

END OF SECTION

SECTION 07 25 00

WEATHER BARRIERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Water-Resistive Barrier: Under exterior wall cladding, over sheathing or other substrate; not air tight or vapor retardant.

B. Vapor Retarders: Materials to make exterior walls, joints between exterior walls and roof, joints around frames of openings in exterior walls, and [_] water vapor resistant and air tight.

C. Air Barriers: Materials that form a system to stop passage of air through exterior walls, joints between exterior walls and roof, and joints around frames of openings in exterior walls.

1.02 RELATED REQUIREMENTS

A. Section 06 1000 - Rough Carpentry: Water-resistive barrier under exterior cladding.

B. Section 06 1000 - Rough Carpentry: Factory applied weather barrier on sheathing.

C. Section 07 2100 - Thermal Insulation: Vapor retarder installed in conjunction with batt insulation.

D. Section 07 6200 - Sheet Metal Flashing and Trim: Metal flashings installed in conjunction with weather barriers.

E. Section 07 9005 - Joint Sealers: Sealant materials and installation techniques.

F. Section 09 2116 - Gypsum Board Assemblies: Water-resistive barrier under exterior cladding.

1.03 DEFINITIONS

A. Weather Barrier: Assemblies that form either water-resistive barriers, air barriers, or vapor retarders.

B. Air Barrier: Air tight barrier made of material that is relatively air impermeable but water vapor permeable, both to the degree specified, with sealed seams and with sealed joints to adjacent surfaces. Note: For the purposes of this specification, vapor impermeable air barriers are classified as vapor retarders.

C. Vapor Retarder: Air tight barrier made of material that is relatively water vapor impermeable, to the degree specified, with sealed seams and with sealed joints to adjacent surfaces.

1. Water Vapor Permeance: For purposes of conversion, 57.2 ng/(Pa s sq m) = 1 perm.

D. Water-Resistive Barrier: Water-shedding barrier made of material that is moisture resistant, to the degree specified, intended to be installed to shed water without sealed seams.

1.04 REFERENCE STANDARDS

A. AATCC Test Method 127 - Water Resistance: Hydrostatic Pressure Test 2018.

B. ASTM D1970/D1970M - Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection 2019.

C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2020.

D. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials 2016.

E. ASTM E1745 - Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs 2017.

F. ASTM E2178 - Standard Test Method for Air Permeance of Building Materials 2013.

G. ICC-ES AC38 - Acceptance Criteria for Water-Resistive Barriers 2016.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on material characteristics.

1.06 QUALITY ASSURANCE

A. Installer Qualifications: Company accredited and certified under the Air Barrier Association of America (ABAA) Quality Assurance Program (QAP).

1.07 FIELD CONDITIONS

A. Maintain temperature and humidity recommended by the materials manufacturers before, during and after installation.

PART 2 PRODUCTS

2.01 WEATHER BARRIER ASSEMBLIES

A. Water-Resistive Barrier: Provide on exterior walls under exterior cladding.

B. Air Barrier:
   1. On outside surface of inside wythe of exterior masonry cavity walls use air barrier coating.
   2. On outside surface of sheathing of exterior walls use air barrier coating.

C. Interior Vapor Retarder:
   1. On inside face of studs of exterior walls, under cladding, use mechanically fastened vapor retarder sheet.

2.02 WATER-RESISTIVE BARRIER MATERIALS (NEITHER AIR BARRIER OR VAPOR RETARDER)

A. Drainable Barrier Sheet: Non-woven and non-perforated polypropylene material with 1/16 inch gap created by spacers providing drainage space.
   1. Air Permeance: 0.004 cfm/sq ft, maximum, when tested in accordance with ASTM E2178.
   2. Width: 5 feet, minimum.
   3. Water Vapor Permeance: 19 perms, minimum, when tested in accordance with ASTM E96/E96M Procedure A (Desiccant Method) at 73.4 degrees F.
   4. Ultraviolet and Weathering Resistance: Approved in writing by manufacturer for up to 120 days of weather exposure.
   5. Surface Burning Characteristics: Flame spread index of 25 or less,

smoke developed index of 450 or less (Class A), when tested in accordance with ASTM E84.

6. Seam and Perimeter Tape: As recommended by sheet manufacturer.
7. Manufacturers:
   a. DuPont; Tyvek Commercial Wrap D.
   b. Substitutions: See Section 01 6000 - Product Requirements.

2.03 AIR BARRIER MATERIALS (WATER VAPOR PERMEABLE AND WATER-RESISTIVE)

A. Air Barrier Sheet, Mechanically Fastened:
   1. Air Permeance: 0.004 cubic feet per minute per square foot, maximum, when tested in accordance with ASTM E2178.
   2. Water Vapor Permeance: 5 perms, minimum, when tested in accordance with ASTM E96/E96M Procedure A (desiccant procedure).
   3. Water Penetration Resistance: Withstand a water head of 21 inches, minimum, for minimum of 5 hours, when tested in accordance with AATCC Test Method 127.
   4. Ultraviolet (UV) and Weathering Resistance: Approved in writing by manufacturer for up to 180 days of weather exposure.
   5. Surface Burning Characteristics: Flame spread index of 25 or less, and smoke developed index of 50 or less, when tested in accordance with ASTM E84.
   6. Water Resistance: Comply with applicable water-resistive requirements of ICC- ES AC38.
   7. Seam and Perimeter Tape: Polyethylene self adhering type, mesh reinforced, 2 inches wide, compatible with sheet material; unless otherwise specified.
   8. Manufacturers:
      a. DuPont Building Innovations; Tyvek Commercial Wrap with FlexWrap NF and Tyvek Tape: www.dupont.com.
      b. National Shelter Products, Inc; DRYLine HP: www.drylinewrap.com/#sle.
      c. Kingspan Insulation LLC; GreenGuard MAX Building Wrap: www.trustgreenguard.com.
      d. VaproShield, LLC; WrapShield: www.vaproshield.com.
      e. Substitutions: See Section 01 6000 - Product Requirements.

2.04 VAPOR RETARDER MATERIALS (AIR BARRIER AND WATER-RESISTIVE)

A. Vapor Retarder Sheet: Type: Dynamic permeability sheeting.
   1. Water Vapor Permeance: dynamic ranging from less than .1 perm to greater than 10 perms varying with prevailing relative humidity levels; when tested in accordance with ASTM E96/E96M.
   2. Fire resistance: Class A, max smoke development 85, meeting ASTM E84.
   3. Seam and Perimeter Tape: As recommended by sheet manufacturer.
   4. Manufacturers:
      a. Membrain as manufactured by Certainteed Saint-Gobain.
      b. Intello Plus as provided by 475 High Perforamnce Building Supply.
         1) 3M Company; [____]: www.3M.com/construction/#sle.
         2) Carlisle Coatings and Waterproofing, Inc; Fire Resist 705FR-A: www.carlisleccw.com/#sle.
         3) Carlisle Coatings and Waterproofing, Inc; CCW-705 Air and

Vapor Barrier Sheet: www.carlisleccw.com/#sle.

4) Carlisle Coatings and Waterproofing, Inc; CCW-705 Air and Vapor Barrier Strips: www.carlisleccw.com/#sle.
5) Substitutions: See Section 01 6000 - Product Requirements.

2.05 SEALANTS

A. Butyl Sealant: Type [___] as specified in Section 07 90 05 .

2.06 ADHESIVES

A. Mastic Adhesive : Compatible with sheet seal and substrate, thick mastic of uniform knife grade consistency.

2.07 ACCESSORIES

A. Flexible Flashing: Self-adhesive sheet flashing complying with ASTM D1970/D1970M, except slip resistance requirement is waived if not installed on a roof.
   1. Composition: Any material that meets physical requirements of ASTM D1970/D1970M with exceptions indicated.
   2. Manufacturers:
      a. DuPont Building Innovations; FlexWrap NF: www.dupont.com/#sle.
      b. DuPont Building Innovations; StraightFlash: www.dupont.com/#sle.
      c. DuPont Building Innovations; StraightFlash VF: www.dupont.com/#sle.
      d. Substitutions: See Section 01 6000 - Product Requirements.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that surfaces and conditions are ready to accept the work of this section.

3.02 PREPARATION

A. Remove projections, protruding fasteners, and loose or foreign matter that might interfere with proper installation.

3.03 INSTALLATION

A. Install materials in accordance with manufacturer's instructions.

B. Water-Resistive Barriers: Install continuous barrier over surfaces indicated, with sheets lapped to shed water but with seams not sealed.

C. Air Barriers: Install continuous air tight barrier over surfaces indicated, with sealed seams and with sealed joints to adjacent surfaces.

D. Vapor Retarders: Install continuous air tight barrier over surfaces indicated, with sealed seams and with sealed joints to adjacent surfaces.
   1. All seams, tears or punctures shall be taped.
   2. Seal top and botom of vapor retarder with continuous bead of sealant.

E. Apply sealants and adhesives within recommended application temperature ranges. Consult manufacturer if temperature is out of this range.

F. Mechanically Fastened Sheets - On Exterior:
   1. Install sheets shingle-fashion to shed water, with seams generally horizontal.
   2. Overlap seams as recommended by manufacturer but at least 6 inches.
   3. Overlap at outside and inside corners as recommended by manufacturer but at least 12 inches.
   4. For applications specified to be air tight, seal seams, laps,

penetrations, tears, and cuts with self-adhesive tape; use only large-headed, gasketed fasteners recommended by the manufacturer.
5. Install water-resistive barrier over jamb flashings.
6. Install air barrier and vapor retarder UNDER jamb flashings.
7. Install head flashings under weather barrier.
8. At openings to be filled with frames having nailing flanges, wrap excess sheet into opening; at head, seal sheet over flange and flashing.

G. Mechanically Fastened Sheets - Vapor Retarder On Interior:
1. When insulation is to be installed in assembly, install vapor retarder over insulation.
2. Anchor to wood framing using large-headed nails or staples at 12 to 18 inches on center along each framing member covered; cover fasteners with seam tape.
3. Seal seams, laps, perimeter edges, penetrations, tears, and cuts with self- adhesive tape, making air tight seal.
4. Locate laps at a framing member; at laps fasten one sheet to framing member then tape overlapping sheet to first sheet.
5. Seal entire perimeter to structure, window and door frames, and other penetrations.
6. Where conduit, pipes, wires, ducts, outlet boxes, and other items are installed in insulation cavity, pass vapor retarder sheet behind item but over insulation and maintain air tight seal.

H. Self-Adhered Sheets:
1. Prepare substrate in manner recommended by sheet manufacturer; fill and tape joints in substrate and between dissimilar materials.
2. Lap sheets shingle-fashion to shed water and seal laps air tight.
3. Once sheets are in place, press firmly into substrate with resilient hand roller; ensure that laps are firmly adhered with no gaps or fishmouths.
4. Use same material, or other material approved by sheet manufacturer for the purpose, to seal to adjacent construction and as flashing.
5. At wide joints, provide extra flexible membrane allowing joint movement.

I. Openings and Penetrations in Exterior Weather Barriers:
1. Install flashing over sills, covering entire sill frame member, extending at least 5 inches onto weather barrier and at least 6 inches up jambs; mechanically fasten stretched edges.
2. At openings to be filled with frames having nailing flanges, seal head and jamb flanges using a continuous bead of sealant compressed by flange and cover flanges with sealing tape at least 4 inches wide; do not seal sill flange.
3. At openings to be filled with non-flanged frames, seal weather barrier to each side of opening framing, using flashing at least 9 inches wide, covering entire depth of framing.
4. At head of openings, install flashing under weather barrier extending at least 2 inches beyond face of jambs; seal weather barrier to flashing.
5. At interior face of openings, seal gap between window/door frame and rough framing, using joint sealant over backer rod.
6. Service and Other Penetrations: Form flashing around penetrating item and seal to weather barrier surface.

3.04 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for additional requirements.

B. Coordination of ABAA Tests and Inspections:
   1. Provide testing and inspection required by ABAA QAP.
   2. Notify ABAA in writing of schedule for air barrier work, and allow adequate time for testing and inspection.
   3. Cooperate with ABAA testing agency.
   4. Allow access to air barrier work areas and staging.
   5. Do not cover air barrier work until tested, inspected, and accepted.

C. Take digital photographs of each portion of the installation prior to covering up.

3.05 PROTECTION

A. Do not leave materials exposed to weather longer than recommended by manufacturer.

END OF SECTION

SECTION 07 3113

ASPHALT SHINGLES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Asphalt shingle roofing.

B. Flexible sheet membranes for eave protection, underlayment, and valley protection.

C. Associated metal flashings and accessories.

1.02 REFERENCE STANDARDS

A. ASTM D226/D226M - Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing 2017.

B. ASTM D1970/D1970M - Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection 2019.

C. ASTM D3161/D3161M - Standard Test Method for Wind-Resistance of Steep Slope Roofing Products (Fan-Induced Method) 2020.

D. ASTM D3462/D3462M - Standard Specification for Asphalt Shingles Made From Glass Felt and Surfaced with Mineral Granules 2019.

E. ASTM D4586/D4586M - Standard Specification for Asphalt Roof Cement, Asbestos- Free 2007 (Reapproved 2018).

F. ASTM D4869/D4869M - Standard Specification for Asphalt-Saturated Organic Felt Underlayment Used in Steep Slope Roofing 2016a.

G. ASTM E108 - Standard Test Methods for Fire Tests of Roof Coverings 2020a.

H. ASTM F1667 - Standard Specification for Driven Fasteners: Nails, Spikes, and Staples 2018a.

I. NRCA MS104 - The NRCA Roofing Manual: Steep-slope Roof Systems 2013.

J. SMACNA (ASMM) - Architectural Sheet Metal Manual 2012.

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data indicating material characteristics.

C. Shop Drawings: For metal flashings, indicate specially configured metal flashings.

D. Samples: Submit two samples of each shingle color indicating color range and finish texture/pattern ; for color selection.

E. Manufacturer's Installation Instructions: Indicate installation criteria and procedures.

F. Warranty: Provide copy of shingle warranty.

1.04 QUALITY ASSURANCE

A. Perform Work in accordance with the recommendations of NRCA Steep

Roofing Manual.

B. Shingles shall carry a 30 year warranty from the manufacturer.

PART 2 PRODUCTS

2.01 ASPHALT SHINGLES

A. Manufacturers:
   1. GAF; Timberline HD Reflector Series: www.gaf.com/sle. Fire Resistance: Class A.
   2. Owens Corning Corp; [___]: www.owenscorning.com/#sle.
   3. IKO
   4. Certainteed Landmark dimensional 30 year shingles. .
   5. Substitutions: See Section 01 6000 - Product Requirements.

B. Asphalt Shingles: Asphalt-coated glass felt, mineral granule surfaced, complying with ASTM D3462.
   1. Wind Resistance: Class A, when tested in accordance with ASTM D3161.
   2. Warranted Wind Speed: Not greater than 60 mph.
   3. Weight: minimum 250 lb/100 sq ft.
   4. Self-sealing type.
   5. Style: Square.
   6. Color: As selected by Architect.

2.02 SHEET MATERIALS

A. Eave Protection Membrane: Self-adhering polymer-modified asphalt sheet complying with ASTM D1970/D1970M; 40 mil total thickness; with strippable treated release paper and polyethylene sheet top surface.

B. Underlayment: Synthetic non-asphaltic sheet, intended by manufacturer for mechanically fastened roofing underlayment without sealed seams.
   1. Type: Woven polypropylene with anti-slip polyolefin coating on both sides.
   2. Self Sealability: Passing nail sealability test specified in ASTM D1970/D1970M.
   3. Flammability: Minimum of Class A, when tested in accordance with ASTM E108.
   4. Ultraviolet (UV) Resistance and Weatherability: Approved in writing by manufacturer for exposure to weather for minimum of six months.
   5. Low Temperature Flexibility: Passing test specified in ASTM D1970/D1970M.
   6. Performance: Meet or exceed requirements for ASTM D226/D226M, Type II asphalt-saturated organic felt.
   7. Liquid Water Transmission: Passes ASTM D4869/D4869M.
   8. Functional Temperature Range: Minus 70 degrees F to 212 degrees F.
   9. Fasteners: As recommended by manufacturer or building code qualification report or approval.

C. Underlayment: Self-adhering rubber-modified asphalt sheet complying with ASTM D1970/D1970M; 22 mil total thickness; with strippable release film and woven polypropylene sheet top surface.
   1. Self Sealability: Passing nail sealability test specified in ASTM D1970/D1970M.
   2. Low Temperature Flexibility: Passing test specified in ASTM

D1970/D1970M.
3. Performance: Meet or exceed requirements for ASTM D226/D226M, Type II asphalt-saturated organic felt.
4. Liquid Water Transmission: Passes ASTM D4869/D4869M.
5. Functional Temperature Range: Minus 70 degrees F to 212 degrees F.

D. Underlayment: Asphalt-saturated organic roofing felt, unperforated, complying with ASTM D226/D226M, Type I ("No.15").

2.03 ACCESSORIES

A. Roofing Nails: Standard round wire shingle type, galvanized steel, stainless steel, aluminum roofing nails, or copper roofing nails, minimum 3/8 inch head diameter, 12 gage, 0.109 inch nail shank diameter, 1-1/2 inch long and complying with ASTM F1667.

B. Nails: Standard round wire shingle type, of hot-dipped zinc coated steel, 10 wire gage, 0.1019 inch shank diameter, 3/8 inch head diameter, of sufficient length to penetrate through roof sheathing or 3/4 inch into roof sheathing or decking.
1. Staples are not permitted to be used.

C. Plastic Cement: ASTM D4586/D4586M, asphalt roof cement.

D. Ridge Vents: Shall be type which can be shingled over: 'VentSure Rigid Roll Ridge Vent' as manufactured by Owens Corning.

2.04 METAL FLASHINGS

A. Metal Flashings: Provide sheet metal eave edge, gable edge, open valley flashing, chimney flashing, dormer flashing, and other flashing indicated.
1. Form flashings to profiles indicated on drawings.
2. Form sections square and accurate to profile, in maximum possible lengths, free from distortion or defects detrimental to appearance or performance.

B. Aluminum Sheet Metal: Prefinished aluminum, 26 gage, 0.017 inch minimum thickness; stucco embossed, PVC coating, [__] color.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions prior to beginning work.

B. Verify that roof deck is of sufficient thickness to accept fasteners.

C. Verify that roof penetrations and plumbing stacks are in place and flashed to deck surface.

D. Verify roof openings are correctly framed.

E. Verify deck surfaces are dry, free of ridges, warps, or voids.

3.02 PREPARATION

A. Broom clean deck surfaces before installing underlayment or eave protection.

B. Install eave edge flashings tight with fascia boards, weather lap joints 2 inches and seal with plastic cement, and secure flange with nails spaced [____] inches on center.

3.03 INSTALLATION - EAVE PROTECTION MEMBRANE

A. Install eave protection membrane from eave edge to minimum 4 ft up-slope beyond interior face of exterior wall.

B. Install eave protection membrane in accordance with manufacturer's instructions and NRCA (RM) applicable requirements.

3.04 INSTALLATION - UNDERLAYMENT

A. Underlayment At Roof Slopes Up to 4:12: Install two layers of underlayment over area not protected by eave protection, with ends and edges weather lapped minimum 4 inches, stagger end laps of each consecutive layer, and nail in place.

B. Underlayment At Roof Slopes Greater Than 4:12: Install underlayment perpendicular to slope of roof, with ends and edges weather lapped minimum 4 inches, stagger end laps of each consecutive layer, nail in place, and weather lap minimum 4 inches over eave protection.

C. Weather lap and seal watertight with plastic cement any items projecting through or mounted on roof.

3.05 INSTALLATION - VALLEY PROTECTION

A. Install valley protection in accordance with SMACNA (ASMM), Detail [__].

B. Install one ply of smooth surfaced roll roofing, minimum 18 inches wide, centered over valleys.

C. Weather lap joints minimum 2 inches.

D. Nail in place minimum 18 inches on center, 1 inch from edges.

E. At Exposed Valleys: Install one layer of sheet metal flashing, minimum 24 inches wide, centered over open valley and crimped to guide water flow, weather lap joints minimum 2 inch wide band of lap cement along each edge of first layer, press roll roofing into cement, nail in place minimum 18 inches on center and 1 inch from edges.

3.06 INSTALLATION - METAL FLASHING AND ACCESSORIES

A. Install flashings in accordance with manufacturer's instructions and NRCA (RM) applicable requirements.

B. Weather lap joints minimum 2 inches and seal weather tight with plastic cement.

C. Secure in place with nails. Conceal fastenings .

D. Items Projecting Through or Mounted on Roofing: Flash and seal weather tight with plastic cement.

3.07 INSTALLATION - SHINGLES

A. Install shingles in accordance with manufacturer's instructions manufacturer's instructions and NRCA (RM) applicable requirements.
   1. Fasten individual shingles using two nails per shingle, or as required by manufacturer and local building code, whichever is greater.
   2. Fasten strip shingles using four nails per strip, or as required by manufacturer and local building code, whichever is greater.

B. Place shingles in straight coursing pattern with 5 inch weather exposure to produce double thickness over full roof area, and provide double course of shingles at eaves.

C. Project first course of shingles 3/4 inch beyond fascia boards.

D. Extend shingles 1/2 inch beyond face of gable edge fascia boards.

E. Extend shingles on one slope across valley and fasten, trim shingles from other

slope 2 inches from valley center line to achieve closed cut valley, and concealing valley protection.

F. Cap hips with individual shingles, maintaining 5 inch weather exposure, and place to avoid exposed nails.

G. After installation, place one daub of plastic cement, one inch diameter under each individual shingle tab exposed to weather, to prevent lifting.

H. Coordinate installation of roof mounted components or work projecting through roof with weather tight placement of counterflashings.

I. Complete installation to provide weather tight service.

END OF SECTION

SECTION 07 46 46

FIBER-CEMENT SIDING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fiber-cement siding.

1.02 RELATED REQUIREMENTS

A. Section 06 1000 - Rough Carpentry: Siding substrate.

B. Section 06 1000 - Rough Carpentry: Water-resistive barrier under siding.

C. Section 07 2500 - WEATHER BARRIERS: Weather barrier under siding.

D. Section 07 9200 - Joint Sealants: Sealing joints between siding and adjacent construction and fixtures.

E. Section 07 9005 - Joint Sealers.

F. Section 09 2116 - Gypsum Board Assemblies: Siding substrate.

G. Section 09 2116 - Gypsum Board Assemblies: Water-resistive barrier under siding.

H. Section 09 9113 - Exterior Painting: Field painting.

1.03 REFERENCE STANDARDS

A. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes 2014.

B. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric) 2013.

C. ASTM C1186 - Standard Specification for Flat Fiber Cement Sheets 2008 (Reapproved 2016).

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Submit manufacturer's data sheets on each product to be used, including:
   1. Manufacturer's requirements for related materials to be installed by others.
   2. Preparation instructions and recommendations.
   3. Storage and handling requirements and recommendations.
   4. Installation methods, including nail patterns.

C. Maintenance Instructions: Periodic inspection recommendations and maintenance procedures.

D. Warranty: Submit copy of manufacturer’s warranty, made out in Owner’s name, showing that it has been registered with manufacturer.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing work of the type specified in this section with minimum five (5) of experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Store products under waterproof cover and elevated above grade, on a flat surface.

PART 2 PRODUCTS

2.01 FIBER-CEMENT SIDING

A. Lap Siding: Individual horizontal boards made of cement and cellulose fiber formed under high pressure with integral surface texture, complying to ASTM C1186, Type A, Grade II; with machined edges, for nail attachment.
   1. Style: Standard lap style.
   2. Texture: Smooth.
   3. Length: 12 ft, nominal.
   4. Width (Height): 7-1/4 inches.
   5. Thickness: 5/16 inch, nominal.
   6. Finish: Factory applied primer.
   7. Color: Finish can be prefinished or field painted. One coat of field painting not requried if prefinished..
   8. Warranty: 50 year limited; transferable.
   9. Manufacturers:
      a. CertainTeed Corporation : www.certainteed.com.
      b. James Hardie Building Products, Inc; [__]: www.jameshardie.com/#sle.
      c. Nichiha USA, Inc; [____]: www.nichiha.com/#sle.
      d. Substitutions: See Section 01 6000 - Product Requirements.

B. Panel Siding: Vertically oriented panels made of cement and cellulose fiber formed under high pressure with integral surface texture, complying to ASTM C1186, Type A, Grade II; with machined edges, for nail attachment.
   1. Texture: As indicated on drawings.
   2. Length (Height): 96 inches, nominal.
   3. Width: 48 inches.
   4. Thickness: 5/16 inch, nominal.
   5. Finish: Factory applied primer.
   6. Color: Panels shall be field painted with a minimum two (2) coats exterior grade paint.
   7. Warranty: 50 year limited; transferable.
   8. Manufacturers:
      a. CertainTeed Corporation : www.certainteed.com.
      b. James Hardie Building Products, Inc; [__]: www.jameshardie.com/#sle.
      c. Nichiha USA, Inc; [____]: www.nichiha.com/#sle.
      d. Substitutions: See Section 01 6000 - Product Requirements.

C. Shingles: Individual "wide" shingles made of cement and cellulose fiber formed under high pressure with integral surface texture, complying with ASTM C1186, Type A, Grade II; with machined edges, for nail attachment.
   1. Style: Straight edged with light wood-grain texture.
   2. Height: 12 inches, nominal.
   3. Thickness: 11/64 inch.
   4. Finish: Factory applied primer.
   5. Color: Shingles shall be field painted with a minimum two (2) coats exterior grade paint..
   6. Warranty: 25 year limited; nontransferable.
   7. Manufacturers:

a. GAF WeatherSide Fiber-Cement Siding; [__]: www.gaf.com/#sle.
b. Substitutions: See Section 01 6000 - Product Requirements.

2.02 ACCESSORIES

A. Trim: Same material and texture as siding.

B. Fasteners: Galvanized or corrosion resistant; length as required to penetrate minimum 1-1/4 inch.

C. Exterior Soffit Vents: One piece, perforated, ASTM B221 (ASTM B221M), 6063 alloy, T5 temper, aluminum, with edge suitable for direct application to gypsum board and manufactured especially for soffit application, and provide continuous vent.

D. Sealant: Elastomeric, polyurethane or silyl-terminated polyether/polyurethane, and capable of being painted.

E. Joint Sealer: As specified in Section 07 9005.

F. Finish Paint: Latex house paint acceptable to siding manufacturer; primer recommended by paint manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine substrate, clean and repair as required to eliminate conditions that would be detrimental to proper installation.

B. Verify that water-resistive barrier has been installed over substrate completely and correctly.

C. Do not begin until unacceptable conditions have been corrected.

D. If substrate preparation is responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 PREPARATION

A. Install Sheet Metal Flashing:
1. Above door and window trim and casings.
2. Above horizontal trim in field of siding.

3.03 INSTALLATION

A. Install in accordance with manufacturer's instructions and recommendations.
1. Read warranty and comply with terms necessary to maintain warranty coverage.
2. Use trim details indicated on drawings.
3. Touch up field cut edges before installing.
4. Pre-drill nail holes if necessary to prevent breakage.

B. Over Wood and Wood-Composite Sheathing: Fasten siding through sheathing into studs.

C. Allow space for thermal movement between both ends of siding panels that butt against trim; seal joint between panel and trim with specified sealant.

D. Joints in Horizontal Siding: Avoid joints in lap siding except at corners; where joints are inevitable stagger joints between successive courses.

E. Joints in Vertical Siding: Install Z-flashing in horizontal joints between successive courses of vertical siding.

F. Do not install siding less than 4 inches from surface of ground nor closer than

1 inch to roofs, patios, porches, and other surfaces where water may collect.

G. Exterior Soffit Vents: Install according to manufacturer's written instructions and in locations indicated on drawings, and provide vent area specified.

H. After installation, seal joints except lap joints of lap siding; seal around penetrations, and paint exposed cut edges.

I. Finish Painting: Within one week after installation, paint siding and trim with one coat primer and two coats finish paint.

3.04 PROTECTION

A. Protect installed products until Date of Substantial Completion.

B. Touch-up, repair or replace damaged products before Date of Substantial Completion.

END OF SECTION

SECTION 07 54 23

THERMOPLASTIC POLYOLEFIN (TPO) MEMBRANE ROOFING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Adhered system with thermoplastic polyolefin (TPO) roofing membrane.

B. Insulation, flat and tapered.

C. Flashings.

D. Roofing cant strips, stack boots, roofing expansion joints, and walkway pads.

1.02 RELATED REQUIREMENTS

A. Section 06 1000 - Rough Carpentry: Wood nailers and curbs.

B. Section 07 6200 - Sheet Metal Flashing and Trim: Counterflashings, reglets and [_____].

1.03 REFERENCE STANDARDS

A. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures Most Recent Edition Cited by Referring Code or Reference Standard.

B. ASTM C1177/C1177M - Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing 2017.

C. ASTM C1289 - Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board 2019.

D. ASTM D6878/D6878M - Standard Specification for Thermoplastic Polyolefin Based Sheet Roofing 2019.

E. NRCA (RM) - The NRCA Roofing Manual 2019.

F. UL 790 - Standard for Standard Test Methods for Fire Tests of Roof Coverings Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's written information listed below.
   1. Product data indicating membrane materials, flashing materials, insulation, vapor retarder, surfacing, and fasteners.

C. Shop Drawings: Indicate joint or termination detail conditions, conditions of interface with other materials, and paver layout.

D. Warranty:
   1. Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.
   2. Submit installer's certification that installation complies with all warranty conditions for the waterproof membrane.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver products in manufacturer's original containers, dry, undamaged, with seals and labels intact.

B. Protect products in weather protected environment, clear of ground and moisture.

C. Protect foam insulation from direct exposure to sunlight.

D. Provide Safety Data Sheets (SDS) at the project site at all times during transportation, storage, and installation of materials.

E. Comply with requirements from Owner to prevent overloading or disturbance of the structure when loading materials onto the roof.

1.06 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. System Warranty: Provide manufacturer's system warranty agreeing to repair or replace roofing that leaks or is damaged due to wind or other natural causes.
   1. Warranty Term: 20 years.
   2. For repair and replacement include costs of both material and labor in warranty.
   3. Include accidental punctures according to the manufacturer's standard warranty terms.
   4. Include hail damage according to the manufacturer's standard warranty terms.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers: Carlisle SynTec: www.carlisle-syntec.com/#sle.
   1. Duro-last
   2. GAF
   3. Johns Manville
   4. Mule-Hide Products Company

B. Substitutions: See Section 01 6000 - Product Requirements.

2.02 ROOFING APPLICATIONS

A. TPO Membrane Roofing: One ply membrane, asphalt adhered, over insulation.

B. Roofing Assembly Performance Requirements and Design Criteria:
   1. Roof Covering External Fire Resistance Classification: Class A when tested per UL 790.
   2. Wind Uplift:
      a. Designed to withstand wind uplift forces calculated with ASCE 7.
   3. Insulation Thermal Resistance (R-Value): Provide R-Value over entire roof deck in accordance with local building code requirements.
   4. Drainage: No standing water within 48 hours after precipitation.

2.03 ROOFING MEMBRANE AND ASSOCIATED MATERIALS

A. Single Source Responsibility: Provide and install products from single source.

B. Membrane:
   1. Material: Thermoplastic Polyolefin (TPO) complying with ASTM D6878/D6878M.
   2. Reinforcing: Internal fabric.
   3. Thickness: 60 mils (0.060 inch), minimum.

4. Sheet Width: Factory fabricated into largest sheets possible.
5. Color: To be selected by Architect from manufacturer's full color range.
6. Product:

C. Seaming Materials: As recommended by membrane manufacturer.

D. Flexible Flashing Material: Same material as membrane.

E. Base Flashing: Provide waterproof, fully adhered base flashing system at all penetrations, plane transitions, and terminations.

F. TPO Profile Rib: heat welded profile ribs, where indicated on the drawings.

2.04 ACCESSORIES

A. Prefabricated Flashing Accessories:
1. Corners and Seams: Same material as membrane, in manufacturer's standard thicknesses.
2. Penetrations: Same material as membrane, with manufacturer's standard cut- outs, rigid inserts, clamping rings, and flanges.
3. Sealant Pockets: Same material as membrane, with manufacturer's standard accessories, in manufacturer's standard configuration.
4. Pressure Sensitive Cover Strips: 6 inch wide, 45 mils (0.045 inch) thick, non- reinforced TPO membrane laminated to 35 mils (0.035 inch) thick cured synthetic rubber with pressure sensitive adhesive.
5. TPO Pressure Sensitive RUSS:
6. Walkway Rolls: Sure-Flex Heat Weldable Walkway Rolls; 80 mils (0.080 inch) thick; gray membrane.
7. Miscellaneous Flashing: Non-reinforced TPO membrane; 80 mils (0.080 inch) thick, in manufacturer's standard lengths and widths.

B. Membrane Adhesive: As recommended by membrane manufacturer.

C. Surface Conditioner for Adhesives: Compatible with membrane and adhesives.

D. Sealants: As recommended by membrane manufacturer.

E. Cleaner: Manufacturer's standard, clear, solvent-based cleaner.

F. Primer: Manufacturer's recommended product.

G. Edgings and Terminations: Manufacturer's standard edge and termination accessories.
1. Snap-On Edge System:
2. Anchor Bar Fascia System:
3. Drip Edge: Carlisle Sure-Seal Drip Edge.
4. Coping:
5. TPO Coated Sheet Metal.
6. Termination Bar.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that surfaces and site conditions are ready to receive work.

B. Verify deck is supported and secure.

C. Verify deck is clean and smooth, flat, free of depressions, waves, or projections, properly sloped and suitable for installation of roof system.

D. Verify deck surfaces are dry and free of snow or ice.

E. Verify that roof openings, curbs, and penetrations through roof are solidly set, and cant strips are in place.

3.02 PREPARATION, GENERAL

A. Clean substrate thoroughly prior to roof application.

3.03 INSTALLATION - GENERAL

A. Perform work in accordance with manufacturer's instructions and NRCA (RM) applicable requirements.

B. Do not apply roofing membrane during unsuitable weather.

C. Do not apply roofing membrane when ambient temperature is outside the temperature range recommended by manufacturer.

D. Do not apply roofing membrane to damp or frozen deck surface or when precipitation is expected or occurring.

E. Do not expose materials vulnerable to water or sun damage in quantities greater than can be weatherproofed the same day.

3.04 MEMBRANE APPLICATION

A. Roll out membrane, free from wrinkles or tears. Place sheet into place without stretching.

B. Shingle joints on sloped substrate in direction of drainage.

C. Fully Adhered Application: Apply adhesive at manufacturer's recommended rate. Fully embed membrane in adhesive except in areas directly over or within 3 inches of expansion joints. Fully adhere one roll before proceeding to adjacent rolls.

D. Seam Welding:
   1. Seam Welding: Overlap edges and ends and seal seams by heat welding, minimum 2 inches.
   2. Cover seams with manufacturer's recommended joint covers.
   3. Probe seams once welds have thoroughly cooled. (Approximately 30 minutes.)
   4. Repair deficient seams within the same day.
   5. Seal cut edges of reinforced membrane after seam probe is complete.

E. At intersections with vertical surfaces:
   1. Extend membrane over cant strips and up a minimum of 4 inches onto vertical surfaces.
   2. Fully adhere flexible flashing over membrane and up to nailing strips.

F. Coordinate installation of roof drains and sumps and related flashings. Locate all field splices away from low areas and roof drains. Lap upslope sheet over downslope sheet.

G. Install walkway pads at areas of concentrated traffic and as shown on Drawings. Space pad joints to permit drainage.

H. Daily Seal: Install daily seal per manufacturers instructions at the end of each work day. Prevent infiltration of water at incomplete flashings, terminations, and at unfinished membrane edges.

3.05 PROTECTION

A. Protect installed roofing and flashings from construction operations.

B. Where traffic must continue over finished roof membrane, protect surfaces using durable materials.

END OF SECTION

SECTION 07 62 00

SHEET METAL FLASHING AND TRIM

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fabricated sheet metal items, including aluminum wrapped trim / fascias., aluminum wrapped trim / fascias., aluminum wrapped trim / fascias., aluminum wrapped trim / fascias., and aluminum wrapped trim / fascias..

B. Aluminum soffits.

C. Sealants for joints within sheet metal fabrications.

D. Precast concrete splash pads.

E. Preformed metal copings.

1.02 RELATED REQUIREMENTS

A. Section 04 2000 - Unit Masonry: Metal flashings embedded in masonry.

B. Section 06 1000 - Rough Carpentry: Wood nailers for sheet metal work.

C. Section 06 1000 - Rough Carpentry: Field fabricated roof curbs.

D. Section 07 3113 - Asphalt Shingles: Non-metallic flashings associated with shingle roofing.

E. Section 07 7100 - Roof Specialties: Manufactured copings, flashings, and expansion joint covers.

F. Section 07 7200 - Roof Accessories: Manufactured metal roof curbs.

G. Section 07 9200 - Joint Sealants: Sealing non-lap joints between sheet metal fabrications and adjacent construction.

H. Section 22 0548 - Vibration and Seismic Controls for Plumbing Piping and Equipment: Vibration isolation curbs for mechanical equipment.

I. Section 23 0548 - Vibration and Seismic Controls for HVAC: Vibration isolation curbs for mechanical equipment.

1.03 REFERENCE STANDARDS

A. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum 2012.

B. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels 2013.

C. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2020.

D. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar 2015.

E. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate 2014.

F. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy

Sheet and Plate (Metric) 2014.

G. ASTM C920 - Standard Specification for Elastomeric Joint Sealants 2014.

H. ASTM D4586/D4586M - Standard Specification for Asphalt Roof Cement, Asbestos- Free 2007 (Reapproved 2012).

I. CDA A4050 - Copper in Architecture - Handbook current edition.

J. SMACNA (ASMM) - Architectural Sheet Metal Manual 2012.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate material profile, jointing pattern, jointing details, fastening methods, flashings, terminations, and installation details.

C. Samples: Submit two samples__by____inch in size illustrating metal finish color.

1.05 QUALITY ASSURANCE

A. Perform work in accordance with SMACNA (ASMM) and CDA A4050 requirements and standard details, except as otherwise indicated.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Stack material to prevent twisting, bending, and abrasion, and to provide ventilation. Slope metal sheets to ensure drainage.

B. Prevent contact with materials that could cause discoloration or staining.

PART 2 PRODUCTS

2.01 SHEET MATERIALS

A. Pre-Finished Galvanized Steel: ASTM A653/A653M, with G90/Z275 zinc coating; minimum 0.02 inch thick base metal, shop pre-coated with PVDF coating.
   1. PVDF (Polyvinylidene Fluoride) Coating: Superior Performance Organic Finish, AAMA 2605; multiple coat, thermally cured fluoropolymer finish system.
   2. Color: As selected by Architect from manufacturer's standard colors.

B. Aluminum: ASTM B209 (ASTM B209M); 20 gage, (0.032 inch) thick; anodized finish of color as selected.

C. Pre-Finished Aluminum: ASTM B209 (ASTM B209M)[<>]; [.027] gauge gutters and
   .019 gauge downspouts inch thick
   1. Fluoropolymer Coating: High Performance Organic Finish, AAMA 2605; multiple coat, thermally cured fluoropolymer finish system.
   2. Color: As selected by Architect from manufacturer's standard colors.

D. Stainless Steel: ASTM A666, Type 304 alloy, soft temper, 28 gage, (0.0156 inch) thick; smooth No. 4 - Brushed finish.

2.02 ACCESSORIES

A. Fasteners: Same material and finish as flashing metal.

B. Primer: Zinc chromate type.

C. Protective Backing Paint: Zinc molybdate alkyd.

D. Sealant to be Concealed in Completed Work: Non-curing butyl sealant.

E. Sealant to be Exposed in Completed Work: ASTM C920; elastomeric

sealant, 100 percent silicone with minimum movement capability of plus/minus 25 percent and recommended by manufacturer for substrates to be sealed; clear.

F. Sealant: Type as specified in Section 07 9005.

G. Plastic Cement: ASTM D4586, Type I.

2.03 FABRICATION

A. Form sections true to shape, accurate in size, square, and free from distortion or defects.

B. Form pieces in longest possible lengths.

C. Hem exposed edges on underside 1/2 inch; miter and seam corners.

D. Form material with flat lock seams, except where otherwise indicated; at moving joints, use sealed lapped, bayonet-type or interlocking hooked seams.

E. Fabricate corners from one piece with minimum 18 inch long legs; seam for rigidity, seal with sealant.

F. Fabricate vertical faces with bottom edge formed outward 1/4 inch and hemmed to form drip.

2.04 GUTTER AND DOWNSPOUT FABRICATION

A. Gutters: 6" SMACNA Type K or Ogee Profile as indicated.

B. Downspouts: 2-3/4" x 4-1/4" SMACNA Corrugated Rectangular Profile profile.

C. Accessories: Profiled to suit gutters and downspouts.
   1. Anchorage Devices: In accordance with SMACNA (ASMM) requirements.
   2. Gutter Supports: Spikes and ferrules.
   3. Downspout Supports: Straps.
   4. Valley splash guards: Prefinished aluminum in same gage as gutters secured to outer edge of 90 degree inside corners at bottom of roof valleys. Scure to inside face of outer gutter edge to form a 90 degree 'L' approximately 6" in height with chamfered top corners.

D. Splash Pads: Precast concrete or solid plastic type, of size and profiles indicated; minimum 3000 psi at 28 days, with minimum 5 percent air entrainment.

E. Downspout Boots: Plastic.

F. Downspout Extenders: Same material and finish as downspouts.

G. Seal metal joints.

2.05 PREFORMED PREFINISHED METAL COPING

A. Coping cap shall be .050" aluminum formed as indicated with allowance for expansion and contraction. Support and fasten to curb with manufacturer's standard chair and cleating system; all fasteners and splice plates concealed. All exposed metal shall be prefinished aluminum coated with full strength Kynar 500 finish with 20 year warranty.

B. Provide Hickman 'Permasnap Coping' .

2.06 ALUMINUM SOFFITS

A. Provide prefinished fully vented aluminum sofits.
   1. Panel width: 16"

2. Thickness: 040"
3. Aluminum Alloy 3105 H28.
4. Color as selected by the Architect.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify roof openings, curbs, pipes, sleeves, ducts, and vents through roof are solidly set, reglets in place, and nailing strips located.

B. Verify roofing termination and base flashings are in place, sealed, and secure.

3.02 PREPARATION

A. Install starter and edge strips, and cleats before starting installation.

B. Back paint concealed metal surfaces with protective backing paint to a minimum dry film thickness of 15 mil.

3.03 INSTALLATION

A. Comply with drawing details.

B. Secure flashings in place using concealed fasteners, and use exposed fasteners only where permitted..

C. Apply plastic cement compound between metal flashings and felt flashings.

D. Fit flashings tight in place; make corners square, surfaces true and straight in planes, and lines accurate to profiles.

E. Seal metal joints watertight.

F. Secure gutters and downspouts in place with concealed fasteners.

G. Connect downspouts to downspout boots, and grout connection watertight.

H. Set splash pads under downspouts, and set in place with [_].

3.04 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for field inspection requirements.

B. Inspection will involve surveillance of work during installation to ascertain compliance with specified requirements.

3.05 SCHEDULE

A. Through-Wall Flashing in Masonry.

B. Fascia and Cornices at roof eave:

C. Gutters and Downspouts:

D. Coping, Cap, Parapet, Sill and Ledge Flashings:

E. Flashings Associated with Shingle Roofing, including Valley, Hip, Ridge, Eave, Gutter Edge, Gable Edge, Chimney:

F. Counterflashings at Roofing Terminations (over roofing base flashings):

G. Counterflashings at Curb-Mounted Roof Items:

H. Roofing Penetration Flashings, for Pipes, Structural Steel, and Equipment Supports:

END OF SECTION

SECTION 07 81 00

APPLIED FIRE PROTECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fireproofing of interior structural steel not exposed to damage or moisture.

1.02 RELATED REQUIREMENTS

A. Section 05 1200 - Structural Steel Framing.

B. Section 07 8123 - Intumescent Fire Protection.

C. Section 07 8205 - Board and Blanket Fireproofing.

D. Section 07 8400 - Firestopping.

E. Section 09 2116 - Gypsum Board Assemblies: Gypsum board fireproofing.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Coordinate with placement of ceiling hanger tabs, mechanical component hangers, and electrical components.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittals procedures.

B. Product Data: Provide data indicating product characteristics.

C. Test Reports: Reports from reputable independent testing agencies for proposed products, indicating compliance with specified criteria, conducted under conditions similar to those on project, as follows:

1. Bond strength.
2. Bond impact.
3. Compressive strength.
4. Fire tests using substrate materials similar those on project.

D. Manufacturer's Installation Instructions: Indicate special procedures.

E. Manufacturer's Certificate: Certify that sprayed-on fireproofing products meet or exceed requirements of contract documents.

F. Manufacturer's Qualification Statement.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience.

1.06 MOCK-UP

A. Construct mock-up, 100 square feet in size.

B. Comply with project requirements for fire ratings.

C. Locate where directed.

D. Examine installation within one hour of application to determine variances from specified requirements due to shrinkage, temperature,

and humidity.

E. Where shrinkage and cracking are evident, adjust mixture and method of application as necessary; remove materials and re-construct mock-up.

F. Mock-up may remain as part of the Work.

1.07 FIELD CONDITIONS

A. Do not apply fireproofing when temperature of substrate material and surrounding air is below 40 degrees F or when temperature is predicted to be below said temperature for 24 hours after application.

B. Provide ventilation in areas to receive fireproofing during application and 24 hours afterward, to dry applied material.

C. Provide temporary enclosure to prevent spray from contaminating air.

1.08 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Correct defective Work within a two year period after Date of Substantial Completion.

1. Include coverage for fireproofing to remain free from cracking, checking, dusting, flaking, spalling, separation, and blistering.
2. Reinstall or repair failures that occur within warranty period.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Applied Fireproofing:

1. Carboline Company; [___]: www.carboline.com.
2. GCP Applied Technologies; [___]: www.gcpat.com/#sle.
3. Isolatek International Inc: www.isolatek.com.
4. Southwest Fireproofing Products Company; [_]: www.sfrm.com/#sle.

2.02 FIREPROOFING ASSEMBLIES

A. Provide assemblies as indicated on drawings.

2.03 MATERIALS

2.04 ACCESSORIES

A. Primer Adhesive: Of type recommended by applied fireproofing manufacturer.

B. Water: Clean, potable.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that surfaces are ready to receive fireproofing.

B. Verify that clips, hangers, supports, sleeves, and other items required to penetrate fireproofing are in place.

C. Verify that ducts, piping, equipment, or other items that would interfere with application of fireproofing have not been installed.

D. Verify that voids and cracks in substrate have been filled.

E. Verify that projections have been removed where fireproofing will be exposed to view as a finish material.

3.02 PREPARATION

A. Perform tests as recommended by fireproofing manufacturer in applications where adhesion of fireproofing to substrate is in question.

B. Remove incompatible materials that could effect bond by scraping, brushing, scrubbing, or sandblasting.

C. Prepare substrates to receive fireproofing in strict accordance with instructions of fireproofing manufacturer.

D. Apply fireproofing manufacturer's recommended bonding agent on primed steel.

E. Protect surfaces not scheduled for fireproofing and equipment from damage by overspray, fall-out, and dusting.

F. Close off and seal duct work in areas where fireproofing is being applied.

3.03 APPLICATION

A. Apply primer adhesive in accordance with manufacturer's instructions.

B. Apply fireproofing in uniform thickness and density as necessary to achieve required ratings.

3.04 FIELD QUALITY CONTROL

A. Perform field inspection and testing in accordance with Section 01 4000 - Quality Requirements.

B. Inspect installed fireproofing after application and curing for integrity, prior to its concealment.

C. Ensure that actual thicknesses, densities, and bond strengths meet requirements for specified ratings and requirements of authorities having jurisdiction (AHJ).

D. Re-inspect installed fireproofing for integrity of fire protection, after installation of subsequent Work.

3.05 CLEANING

A. Remove excess material, overspray, droppings, and debris.

B. Remove fireproofing from materials and surfaces not required to be fireproofed.

END OF SECTION

SECTION 07 84 00

FIRESTOPPING

PART 1 GENERAL

1.01 RELATED REQUIREMENTS

A. Section 01 7000 - Execution and Closeout Requirements: Cutting and patching.

B. Section 07 0553 - Fire and Smoke Assembly Identification.

C. Section 07 8100 - Applied Fire Protection.

D. Section 09 2116 - Gypsum Board Assemblies: Gypsum wallboard fireproofing.

1.02 REFERENCE STANDARDS

A. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials 2020.

B. ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems 2013a (Reapproved 2017).

C. ASTM E1966 - Standard Test Method for Fire-Resistive Joint Systems 2015 (Reapproved 2019).

D. ASTM E2174 - Standard Practice for On-Site Inspection of Installed Firestop Systems 2020a.

E. ASTM E2393 - Standard Practice for On-Site Inspection of Installed Fire Resistive Joint Systems and Perimeter Fire Barriers 2020.

F. ASTM E2307 - Standard Test Method for Determining Fire Resistance of Perimeter Fire Barriers Using Intermediate-Scale, Multi-story Test Apparatus 2020.

G. ASTM E2837 - Standard Test Method for Determining the Fire Resistance of Continuity Head-of-Wall Joint Systems Installed Between Rated Wall Assemblies and Nonrated Horizontal Assemblies 2013 (Reapproved 2017).

H. ITS (DIR) - Directory of Listed Products current edition.

I. FM 4991 - Approval Standard for Firestop Contractors 2013.

J. FM (AG) - FM Approval Guide current edition.

K. FA (AG) - FM Approval Guide; Factory Mutual Research Corporation; current edition.

L. SCAQMD 1168 - Adhesive and Sealant Applications 1989 (Amended 2017).

M. UL 2079 - Standard for Tests for Fire Resistance of Building Joint Systems Current Edition, Including All Revisions.

N. UL (DIR) - Online Certifications Directory Current Edition.

O. UL (FRD) - Fire Resistance Directory Current Edition.

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Schedule of Firestopping: List each type of penetration, fire rating of the

penetrated assembly, and firestopping test or design number.

C. Product Data: Provide data on product characteristics, performance ratings, and limitations.

D. Sustainable Design Submittal: Submit VOC content documentation for all non- preformed materials.

E. Manufacturer's Installation Instructions: Indicate preparation and installation instructions.

F. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

G. Certificate from authority having jurisdiction indicating approval of materials used.

H. Installer Qualification: Submit qualification statements for installing mechanics.

1.04 QUALITY ASSURANCE

A. Fire Testing: Provide firestopping assemblies of designs that provide the scheduled fire ratings when tested in accordance with methods indicated, ASTM E119, and ASTM E814.
   1. Listing in UL (FRD), FM (AG), or ITS (DIR) will be considered as constituting an acceptable test report.
   2. Valid evaluation report published by ICC Evaluation Service, Inc. (ICC-ES) at www.icc-es.org will be considered as constituting an acceptable test report.
   3. Submission of actual test reports is required for assemblies for which none of the above substantiation exists.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

C. Installer Qualifications: Company specializing in performing the work of this section and:
   1. Approved by Factory Mutual Research Corporation under FM 4991, or meeting any two of the following requirements:
   2. Verification of at least five satisfactorily completed projects of comparable size and type.
   3. Licensed by local authorities having jurisdiction (AHJ).

D. Coordination: Cross-coordinate rated and structural assemblies with penetrating products shown on plans and shop drawings of work by other divisions.

1.05 MOCK-UP

A. Install one firestopping assembly representative of each fire rating design required on project.
   1. Where one design may be used for different penetrating items or in different wall constructions, install one assembly for each different combination.

B. If accepted, mock-up will represent minimum standard for the Work.

C. If accepted, mock-up may remain as part of the Work. Remove and replace mock-ups not accepted.

1.06 FIELD CONDITIONS

A. Comply with firestopping manufacturer's recommendations for temperature and conditions during and after installation; maintain minimum temperature before, during, and for three days after installation of materials.

B. Provide ventilation in areas where solvent-cured materials are being installed.

PART 2 PRODUCTS

2.01 MATERIALS

A. Manufacturers:
   1. A/D Fire Protection Systems Inc.; [___]: www.adfire.com.
   2. 3M Fire Protection Products; [___]: www.3m.com/firestop.
   3. Hilti, Inc: www.us.hilti.com/#sle.
   4. Nelson FireStop Products; [___]: www.nelsonfirestop.com.
   5. Specified Technologies, Inc.; [___]: www.stifirestop.com.
   6. Substitutions: See Section 01 6000 - Product Requirements.

B. Materials: Use any material meeting requirements.

C. Volatile Organic Compound (VOC) Content: Provide products having VOC content lower than that required by SCAQMD 1168.

D. Primers, Sleeves, Forms, Insulation, Packing, Stuffing, and Accessories: Provide type of materials as required for tested firestopping assembly.

E. Fire Ratings: Refer to drawings for required systems and ratings.

2.02 FIRESTOPPING ASSEMBLY REQUIREMENTS

A. Through Penetration Firestopping: Use system that has been tested according to ASTM E814 to have fire resistance F Rating equal to required fire rating of penetrated assembly.
   1. Listing by FM (AG), ITS (DIR), UL (DIR), or UL (FRD) in their certification directories will be considered evidence of successful testing.

B. Membrane Penetration Firestopping: For all membrane penetrations, provide firestopping systems that have been tested according to ASTM E814 to have a pressure differential of .01" of water, and with fire resistance, F and T Rating not less than the required fire rating of penetrated assembly.

C. For non-standard firestopping applications (including but not limited to plumbing cleanouts, electrical panels, etc) in rated and/or structural bearing walls, provide listed systems with supporting fire engineering determination for modifications as required by the local building and fire authorities.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify openings are ready to receive the work of this section.

3.02 PREPARATION

A. Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other materials that could adversely affect bond of firestopping material.

B. Remove incompatible materials that could adversely affect bond.

C. Install backing materials to prevent liquid material from leakage.

3.03 INSTALLATION

A. Install materials in manner described in fire test report and in accordance with manufacturer's instructions, completely closing openings.

B. Do not cover installed firestopping until inspected by authorities having jurisdiction.

C. Install labeling required by code.

3.04 FIELD QUALITY CONTROL

A. Independent Testing Agency: Inspection agency employed and paid by Owner, will examine penetration firestopping in accordance with ASTM E2174, and ASTM E2393.

B. Repair or replace penetration firestopping and joints at locations where inspection results indicate firestopping or joints do not meet specified requirements.

3.05 CLEANING

A. Clean adjacent surfaces of firestopping materials.

3.06 PROTECTION

A. Protect adjacent surfaces from damage by material installation.

END OF SECTION

SECTION 07 90 05

JOINT SEALERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Sealants and joint backing.

B. Precompressed foam sealers.

1.02 RELATED REQUIREMENTS

A. Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions.

B. Section 07 8400 - Firestopping: Firestopping sealants.

C. Section 09 2116 - Gypsum Board Assemblies: Acoustic sealant.

D. Section 09 3000 - Tiling: Sealant used as tile grout.

1.03 REFERENCE STANDARDS

A. ASTM C834 - Standard Specification for Latex Sealants 2017.

B. ASTM C919 - Standard Practice for Use of Sealants in Acoustical Applications 2018.

C. ASTM C920 - Standard Specification for Elastomeric Joint Sealants 2018.

D. ASTM C1193 - Standard Guide for Use of Joint Sealants 2016.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordinate the work with other sections referencing this section.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. LEED Report: Submit VOC content documentation for all non-preformed sealants and primers.

C. Manufacturer's Installation Instructions: Indicate special procedures.

1.06 QUALITY ASSURANCE

A. Applicator Qualifications: Company specializing in performing the work of this section with minimum five years experience and approved by manufacturer.

1.07 MOCK-UP

A. Provide mock-up of sealant joints in conjunction with window under provisions of Section 01 4000.

B. Construct mock-up with specified sealant types and with other components noted.

C. Locate where directed.

D. Mock-up may remain as part of the Work.

1.08 FIELD CONDITIONS

A. Maintain temperature and humidity recommended by the sealant manufacturer during and after installation.

1.09 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Correct defective work within a five year period after Date of Substantial Completion.

C. Warranty: Include coverage for installed sealants and accessories which fail to achieve airtight seal, exhibit loss of adhesion or cohesion, or do not cure.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Gunnable and Pourable Sealants:
1. Adhesives Technology Corporation: www.atc.ws.
2. BASF Construction Chemicals-Building Systems: www.buildingsystems.basf.com.
3. Bostik Inc: www.bostik-us.com.
4. ARDEX Engineered Cements: www.ardexamericas.com.
5. Dow Corning Corporation: www.dowcorning.com.
6. Hilti, Inc: www.us.hilti.com.
7. Substitutions: See Section 01 6000 - Product Requirements.

B. Preformed Compressible Foam Sealers:
1. EMSEAL Joint Systems, Ltd; Product [_]: www.emseal.com.
2. Sandell Manufacturing Company, Inc; Product [____]: www.sandellmfg.com.
3. Dayton Superior Corporation; Product [_]: www.daytonsuperior.com.
4. Tremco Global Sealants; Product [__]: www.tremcosealants.com.
5. Substitutions: See Section 01 6000 - Product Requirements.

2.02 SEALANTS

A. Sealants and Primers - General: Provide products having volatile organic compound (VOC) content as specified in Section 01 6116.

B. General Purpose Exterior Sealant: Silane Modified Polymer (SMP); ASTM C920, Type S, Grade NS, Class 50, Uses Masonry, wood, metal, plastic; single component.
1. Color: Match adjacent finished surfaces.
2. Applications: Use for:
   a. Control, expansion, and soft joints in masonry.
   b. Joints between concrete and other materials.
   c. Joints between metal/wood frames and other materials.
   d. Joints at vinyl, cementitious or wood siding.
   e. Other exterior joints for which no other sealant is indicated.
3. Silane Modified Polymer (SMP) Products:
   a. OSI Quad Max: http://www.ositough.com.

C. Type [___] - General Purpose Interior Sealant: Acrylic emulsion latex; ASTM C834, Type OP, Grade NF single component, paintable.
1. Color: Match adjacent finished surfaces.
2. Applications: Use for:
   a. Interior wall and ceiling control joints.
   b. Joints between door and window frames and wall surfaces.
   c. Other interior joints for which no other type of sealant is indicated.

3. Products:
   a. Bostik Inc; [___]: www.bostik-us.com.
   b. Pecora Corporation; AC-20 + Silicone Acrylic Latex Caulking Compound: www.pecora.com.
   c. BASF Construction Chemicals-Building Systems; [_____]: www.buildingsystems.basf.com.
   d. Sherwin-Williams Company; White Lightning 3006 Siliconized Acrylic Latex Caulk: www.sherwin-williams.com.
   e. Tremco Global Sealants; [__]: www.tremcosealants.com.

D. Bathtub/Tile Sealant: Silicone; ASTM C920, Uses I, M and A; single component, mildew resistant.
1. Applications: Use for:
   a. Joints between plumbing fixtures and floor and wall surfaces.
   b. Joints between kitchen and bath countertops and wall surfaces.
2. Color: Match adjacent finished surfaces except at plastic laminate countertops use clear.
3. Products:
   a. Bostik Inc; [___]: www.bostik-us.com.
   b. BASF Construction Chemicals-Building Systems; [_____]: www.buildingsystems.basf.com.
   c. Pecora Corporation; 898NST Sanitary Silicone Sealant - Class 50: www.pecora.com.
   d. Tremco Global Sealants; [__]: www.tremcosealants.com.
   e. Substitutions: See Section 01 6000 - Product Requirements.

E. Type [___] - Acoustical Sealant for Concealed Locations:
1. Composition: Acrylic latex emulsion sealant.
2. Applications: Use for concealed locations only:
   a. Sealant bead between top stud runner and structure and between bottom stud track and floor.
3. Products:
   a. Bostik Inc; [___]: www.bostik-us.com.
   b. Pecora Corporation: www.pecora.com.
   c. BASF Construction Chemicals-Building Systems; [_____]: www.buildingsystems.basf.com.
   d. Tremco Global Sealants; [__]: www.tremcosealants.com.
   e. Hilti, Inc.; CP 506 Smoke and Acoustical Sealant: www.us.hilti.com.
   f. Substitutions: See Section 01 6000 - Product Requirements.

F. Type [___] - Interior Floor Joint Sealant: Polyurethane, self-leveling; ASTM C920, Grade P, Class 25, Uses T, M and A; single component.
1. Approved by manufacturer for wide joints up to 1-1/2 inches.
2. Color: Match adjacent finished surfaces.
3. Applications: Use for:
   a. Expansion joints in floors.
   b. Other floor joints.
4. Products:

a. Bostik Inc; [___]: www.bostik-us.com.
b. Pecora Corporation; NR-201 Self-Leveling Traffic and Loop Sealant: www.pecora.com.
c. BASF Construction Chemicals-Building Systems; [_____]: www.buildingsystems.basf.com.
d. Sherwin-Williams Company; Stampede 1SL Polyurethane Sealant: www.sherwin-williams.com.
e. Substitutions: See Section 01 6000 - Product Requirements.

G. Type [___] - Concrete Paving Joint Sealant: Polyurethane, self-leveling; ASTM C920, Class 25, Uses T, I, M and A; single component.
1. Color: Gray.
2. Applications: Use for:
a. Joints in sidewalks and vehicular paving.
b. Expansion joints abutting building..
3. Products:
a. Bostik Inc; [___]: www.bostik-us.com.
b. Pecora Corporation; NR-201 Self-Leveling Traffic and Loop Sealant: www.pecora.com.
c. BASF Construction Chemicals-Building Systems; [_____]: www.buildingsystems.basf.com.
d. Sherwin-Williams Company; Stampede 1SL Polyurethane Sealant: www.sherwin-williams.com.
e. Substitutions: See Section 01 6000 - Product Requirements.

2.03 ACCESSORIES

A. Primer: Non-staining type, recommended by sealant manufacturer to suit application.

B. Joint Cleaner: Non-corrosive and non-staining type, recommended by sealant manufacturer; compatible with joint forming materials.

C. Joint Backing: Round foam rod compatible with sealant; ASTM D 1667, closed cell PVC; oversized 30 to 50 percent larger than joint width..

D. Bond Breaker: Pressure sensitive tape recommended by sealant manufacturer to suit application.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrate surfaces are ready to receive work.

B. Verify that joint backing and release tapes are compatible with sealant.

3.02 PREPARATION

A. Remove loose materials and foreign matter that could impair adhesion of sealant.

B. Clean and prime joints in accordance with manufacturer's instructions.

C. Perform preparation in accordance with manufacturer's instructions and ASTM C1193.

D. Protect elements surrounding the work of this section from damage or

disfigurement.

3.03 INSTALLATION

A. Perform work in accordance with sealant manufacturer's requirements for preparation of surfaces and material installation instructions.

B. Perform installation in accordance with ASTM C1193.

C. Perform acoustical sealant application work in accordance with ASTM C919.

D. Measure joint dimensions and size joint backers to achieve width-to-depth ratio, neck dimension, and surface bond area as recommended by manufacturer, except where specific dimensions are indicated.

E. Install bond breaker where joint backing is not used.

F. Install sealant free of air pockets, foreign embedded matter, ridges, and sags.

G. Apply sealant within recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.

H. Tool joints concave.

3.04 CLEANING

A. Clean adjacent soiled surfaces.

3.05 PROTECTION

A. Protect sealants until cured.

END OF SECTION

SECTION 08 11 13

HOLLOW METAL DOORS AND FRAMES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Non-fire-rated hollow metal doors and frames.
B. Fire-rated hollow metal doors and frames.
C. Thermally insulated hollow metal doors with frames.
D. Sound-rated hollow metal doors and frames.
E. Hollow metal borrowed lites glazing frames.
F. Accessories, including glazing, louvers, and matching panels.

1.02 RELATED REQUIREMENTS

A. Section 08 7100 - Door Hardware.
B. Section 08 8000 - Glazing: Glass for doors and borrowed lites.
C. Section 09 9113 - Exterior Painting: Field painting.
D. Section 09 9123 - Interior Painting: Field painting.

1.03 ABBREVIATIONS AND ACRONYMS

A. ANSI - American National Standards Institute.
B. ASCE - American Society of Civil Engineers.
C. HMMA - Hollow Metal Manufacturers Association.
D. NAAMM - National Association of Architectural Metal Manufacturers.
E. NFPA - National Fire Protection Association.
F. SDI - Steel Door Institute.
G. UL - Underwriters Laboratories.

1.04 REFERENCE STANDARDS

A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design 2010.
B. ANSI/ICC A117.1 - American National Standard for Accessible and Usable Buildings and Facilities; International Code Council; 2009.
C. ANSI/SDI A250.4 - Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames and Frame Anchors 2011.
D. ANSI/SDI A250.8 - Specifications for Standard Steel Doors and Frames (SDI-100) 2017.
E. ANSI/SDI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames 2011.
F. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2020.
G. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled,

Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Required Hardness, Solution Hardened, and Bake Hardenable 2020.

H. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength 2018a.

I. BHMA A156.115 - American National Standard for Hardware Preparation in Steel Doors and Steel Frames 2016.

J. ICC A117.1 - Accessible and Usable Buildings and Facilities 2017.

K. ITS (DIR) - Directory of Listed Products current edition.

L. NAAMM HMMA 830 - Hardware Selection for Hollow Metal Doors and Frames 2002.

M. NAAMM HMMA 831 - Hardware Locations for Hollow Metal Doors and Frames 2011.

N. NAAMM HMMA 840 - Guide Specifications For Receipt, Storage and Installation of Hollow Metal Doors and Frames 2007.

O. NAAMM HMMA 861 - Guide Specifications for Commercial Hollow Metal Doors and Frames 2014.

P. NFPA 80 - Standard for Fire Doors and Other Opening Protectives 2019.

Q. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies 2017.

R. SDI 117 - Manufacturing Tolerances for Standard Steel Doors and Frames 2013.

S. UL (BMD) - Building Materials Directory; current edition.

T. UL (DIR) - Online Certifications Directory Current Edition.

U. UL 10C - Standard for Positive Pressure Fire Tests of Door Assemblies Current Edition, Including All Revisions.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Materials and details of design and construction, hardware locations, reinforcement type and locations, anchorage and fastening methods, and finishes; and one copy of referenced standards/guidelines.

C. Shop Drawings: Details of each opening, showing elevations, glazing, frame profiles, and any indicated finish requirements.

D. Samples: Submit two samples of metal, 2 inch by 2 inch in size showing factory finishes, colors, and surface texture.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years documented experience.

B. Maintain at project site copies of reference standards relating to installation of products specified.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Comply with NAAMM HMMA 840 or ANSI/SDI A250.8 (SDI-100) in

accordance with specified requirements.

B. Protect with resilient packaging; avoid humidity build-up under coverings; prevent corrosion and adverse effects on factory applied painted finish.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Hollow Metal Doors and Frames:
   1. Ceco Door, an Assa Abloy Group company: www.assaabloydss.com.
   2. De La Fontaine Inc: www.delafontaine.com.
   3. De La Fontaine Inc: www.delafontaine.com.
   4. De La Fontaine Inc: www.delafontaine.com.
   5. Republic Doors: www.republicdoor.com.
   6. Steelcraft, an Allegion brand: www.allegion.com/us.
   7. Technical Glass Products; SteelBuilt Window & Door Systems: www.tgpamerica.com/#sle.
   8. Substitutions: See Section 01 6000 - Product Requirements.

2.02 DESIGN CRITERIA

A. Requirements for Hollow Metal Doors and Frames:
   1. Steel used for fabrication of doors and frames shall comply with one or more of the following requirements; Galvannealed steel complying with ASTM A653/A653M, cold-rolled steel complying with ASTM A1008/A1008M, or hot-rolled pickled and oiled (HRPO) steel complying with ASTM A1011/A1011M, Commercial Steel (CS) Type B for each.
   2. Accessibility: Comply with ICC A117.1 and ADA Standards.
   3. Exterior Door Top Closures: Flush end closure channel, with top and door faces aligned.
   4. Door Edge Profile: Manufacturers standard for application indicated.
   5. Typical Door Face Sheets: Flush.
   6. Glazed Lights: Non-removable stops on non-secure side; sizes and configurations as indicated on drawings. Style: Manufacturers standard.
   7. Hardware Preparations, Selections and Locations: Comply with NAAMM HMMA 830 and NAAMM HMMA 831 or BHMA A156.115 and ANSI/SDI A250.8 (SDI-100) in accordance with specified requirements.
   8. Zinc Coating for Typical Interior and/or Exterior Locations: Provide metal components zinc-coated (galvanized) and/or zinc-iron alloy-coated (galvannealed) by the hot-dip process in accordance with ASTM A653/A653M, with manufacturer's standard coating thickness, unless noted otherwise for specific hollow metal doors and frames.
      a. Based on SDI Standards: Provide at least A40/ZF120 (galvannealed) when necessary, coating not required for typical interior door applications, and at least A60/ZF180 (galvannealed) for corrosive locations.

B. Hollow Metal Panels: Same construction, performance, and finish as doors.

C. Combined Requirements: If a particular door and frame unit is indicated to comply with more than one type of requirement, comply with the specified requirements for each type; for instance, an exterior door that is also indicated as being sound-rated must comply with the requirements specified for exterior doors and for sound-rated doors; where two requirements conflict, comply with

the most stringent.

2.03 HOLLOW METAL DOORS

A. Exterior Doors: Thermally insulated.
   1. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).
      a. Level 1 - Standard-duty.
      b. Physical Performance Level C, 250,000 cycles; in accordance with ANSI/SDI A250.4.
      c. Model 1 - Full Flush.
      d. Door Face Metal Thickness: 20 gage, 0.032 inch, minimum.
   2. Door Thickness: 1-3/4 inch, nominal.

B. Interior Doors, Non-Fire Rated:
   1. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).
      a. Level 1 - Standard-duty.
      b. Physical Performance Level C, 250,000 cycles; in accordance with ANSI/SDI A250.4.
      c. Model 1 - Full Flush.
      d. Door Face Metal Thickness: 20 gage, 0.032 inch, minimum.
   2. Door Thickness: 1-3/4 inch, nominal.

C. Fire-Rated Doors:
   1. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).
      a. Level 1 - Standard-duty.
      b. Physical Performance Level C, 250,000 cycles; in accordance with ANSI/SDI A250.4.
      c. Model 1 - Full Flush.
      d. Door Face Metal Thickness: 20 gage, 0.032 inch, minimum.
   2. Fire Rating: As indicated on Door Schedule, tested in accordance with UL 10C and NFPA 252 ("positive pressure fire tests").
      a. Provide units listed and labeled by UL (DIR) or ITS (DIR).
      b. Attach fire rating label to each fire rated unit.
   3. Door Thickness: 1-3/4 inch, nominal.

D. Type [___] , Sound-Rated Interior Doors:
   1. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).
      a. Level 1 - Standard-duty.
      b. Physical Performance Level C, 250,000 cycles; in accordance with ANSI/SDI A250.4.
      c. Model 1 - Full Flush.
      d. Door Face Metal Thickness: 20 gage, 0.032 inch, minimum.
   2. Door Thickness: As required to meet acoustic requirements indicated.

2.04 HOLLOW METAL FRAMES

A. Comply with standards and/or custom guidelines as indicated for corresponding door in accordance with applicable door frame requirements.

B. Exterior Door Frames: Face welded type.
   1. Weatherstripping: Separate, see Section 08 7100.

C. Interior Door Frames, Non-Fire Rated: Knock-down type.

D. Door Frames, Fire-Rated: Knock-down type.
   1. Fire Rating: Same as door, labeled.

E. Sound-Rated Door Frames: Knock-down type.

F. Borrowed Lites Glazing Frames: Construction and face dimensions to match door frames, and as indicated on drawings.

2.05 FINISHES

A. Primer: Rust-inhibiting, complying with ANSI/SDI A250.10, door manufacturer's standard.

2.06 ACCESSORIES

A. Louvers: Roll formed steel with overlapping frame; finish same as door components ; factory-installed.
   1. In Fire-Rated Doors: UL (DIR) or ITS (DIR) listed fusible link louver, same rating as door.

B. Glazing: As specified in Section 08 8000, factory installed.

C. Removable Stops: Formed sheet steel, shape as indicated on drawings, mitered or butted corners; prepared for countersink style tamper proof screws.

D. Silencers: Resilient rubber, fitted into drilled hole; provide three on strike side of single door, three on center mullion of pairs, and two on head of pairs without center mullions.

E. Temporary Frame Spreaders: Provide for factory- or shop-assembled frames.

2.07 FINISHES

A. Primer: Rust-inhibiting, complying with ANSI/SDI A250.10, door manufacturer's standard.

B. Bituminous Coating: Asphalt emulsion or other high-build, water-resistant, resilient coating.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that opening sizes and tolerances are acceptable.

C. Verify that finished walls are in plane to ensure proper door alignment.

D. Verify necessary flashings are in place at exterior doors before installation.

3.02 PREPARATION

A. Coat inside of frames to be installed in masonry or to be grouted, with bituminous coating, prior to installation.

3.03 INSTALLATION

A. Install doors and frames in accordance with manufacturer's instructions and related requirements of specified door and frame standards or custom guidelines indicated.

B. Install fire rated units in accordance with NFPA 80.

C. Coordinate frame anchor placement with wall construction.

D. Install door hardware as specified in Section 08 7100.

E. Comply with glazing installation requirements of Section 08 8000.

F. At exterior doors install necessary flashing at head of door appropriate to the

detail and adjacent materials.

G. Coordinate installation of electrical connections to electrical hardware items.

3.04 TOLERANCES

A. Clearances Between Door and Frame: Comply with related requirements of specified frame standards or custom guidelines indicated in accordance with SDI 117 or NAAMM HMMA 861.

B. Maximum Diagonal Distortion: 1/16 inch measured with straight edge, corner to corner.

3.05 ADJUSTING

A. Adjust for smooth and balanced door movement.

B. Adjust sound control doors so that seals are fully engaged when door is closed.

3.06 SCHEDULE

A. Refer to Door and Frame Schedule on the drawings.

END OF SECTION

SECTION 08 14 00

WOOD DOORS

PART 1 GENERAL

1.01 WORK INCLUDED

A. Provide the following types of wood doors:

1. Solid core
2. Fire rated
3. Stile and rail
4. Acoustic
5. Lead lined

1.02 RELATED SECTIONS

A. Hollow Metal Door Frames: Section 08 11 13.

B. Door Hardware Section 08 71 10.

C. Sustainable Design Requirements: Section 01 81 13.

D. VOC Limits: Section 01 81 16.

1.03 QUALITY ASSURANCE

A. Provide wood doors fabricated by one manufacturer to ensure uniformity in appearance and construction.

B. Reference Standards

1. Underwriters' Laboratories - UL 10C (positive pressure) - Fire Tests of Door Assemblies
2. Window and Door Manufacturers Association (WDMA): WDMA IS 1A-04.
3. Architectural Wood Work Institute: AWI "Quality Standards, Guide Specification" requirements.
4. NFPA 80 - Fire Doors and Windows
5. NFPA 252 - Standard Methods of Fire Tests for Door Assemblies

1.04 SUBMITTALS

A. Submit manufacturer's product data and installation instructions for each type of wood door required.

1. Include details of core and edge construction.

2. Include certification indicating compliance with specification requirements.

B. Submit Shop Drawings

1. Indicate location and size of each door, elevation of each kind of door, details of construction, location and extent of hardware blocking and other pertinent data.
2. Identify doors in accordance with drawing door schedule.

C. Submit sample corner section, 12" square, showing required veneer and edge construction.

D. Finish Samples

1. Factory Finished Doors: Submit three (3) flitch samples of each species of face veneer with factory applied stain and finish as specified and indicated illustrating expected range of color and grain variation.
2 Field Finished Doors: Submit three (3) flitch samples of each species of face veneer as specified and indicated illustrating expected range of grain variation. Samples will be used to select and approve field stain color as specified in Section 09 91 00.

E. Sustainable Design Documentation Submittals: Comply with Section 01 81 13.

1. VOC Limits: Include documentation verifying product Low Emitting Material Building Product Disclosures and Optimization.

1.05 DELIVERY, STORAGE AND HANDLING

A. Store and protect doors in accordance with manufacturer's recommendations and WDMA.

B. Following are general guidelines. For more specific information refer to WDMA's Appendix Section “Care and Installation at Job Site.”

1. Deliver doors in manufacturer's original unopened protective packaging or wrapper.
   a. Store doors flat and off the floor on a level surface in a dry, well-ventilated building. Do not store on edge. Protect doors from dirt, water and abuse.
   b. Do not subject interior doors to extremes in either heat or humidity. HVAC systems should be operational and balanced, providing a temperature range of 50 to 90 degrees Fahrenheit and 30% to 50% relative humidity.
   c. When handling doors, always lift and carry. Do not drag across other doors or surfaces. Handle with clean hands or gloves.
   d. Each door will be marked on top rail with opening number.

1.06 LABEL DOOR REQUIREMENTS

A. Fire Ratings Compliance: Comply with the label requirements of NFPA and applicable local codes. Fabricate doors and frames in accordance with requirements of NFPA Standard No. 80 and U.L. Standards as follows:

1. Positive Pressure Testing UL 10C

B. Ratings Certifications

1. Provide U.L. labels permanently fastened on each door that is within the size limitations established by NFPA and U.L. for labeling.
2. Provide anchors for U.L. labeled frames required by the authority having jurisdiction.

1.07 WARRANTY

A. Manufacturer agrees to repair or replace doors that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:
   a. Warping (bow, cup, or twist) more than 1/4 inch in a 42-by-84-inch section.
   b. Telegraphing of core construction in face veneers exceeding 0.01 inch in a 3-inch span.
2. Warranty Period for Solid-Core Exterior Doors: Two years from date of Substantial Completion.
3. Warranty Period for Solid-Core Interior Doors: Life of installation.

PART 2 PRODUCTS

2.01 MATERIALS AND COMPONENTS

A. General: Provide materials that comply with Project Sustainable Design Requirements and Low Emitting Material goals.

B. Interior Flush Doors Solid Core: Meet or exceed WDMA I.S.1A Industry Standard for Wood Flush Doors requirements and as specified. WDMA I.S.1A. Performance Grade – Heavy Duty.

1. Interior Flush Doors Solid Core – Non-Rated and 20 Minute Rated Fire Doors: Provide one of the following cores with hardwood veneers:
   a. Particleboard-Core: ANSI A208.1, Grade LD-1 or Grade LD-2.
   b. Blocking: Provide wood blocking in particleboard-core doors as needed to eliminate through-bolting hardware
      1) 5-inch top-rail blocking, in doors indicated to have closers.
      2) 5-inch bottom-rail blocking, in exterior doors and doors indicated to have kick, mop, or armor plates.
   c. Provide doors with glued-wood-stave or structural-composite-lumber] cores instead of particleboard cores for doors indicated to

receive exit devices.

b. Structural Composite Lumber Core (SCLC-5) is an engineered hardwood composite sometimes referred to as LSL (Laminated Strand Lumber). The material complies with WDMA minimum performance levels for interior applications with screw holding power of 540 lbs., modulus of rupture of 6,500 psi, and density of 38 lbs per cubic foot. Formaldehyde free.

2. Interior Flush Fire Doors – Above 20 Minute Rated: FD solid core with hardwood face veneer.
   a. Rating as indicated on drawings.
   b. Provide one of the above cores or the following as required to maintain fire rating:
      1) Non-combustible mineral composite material that is necessary for higher hourly ratings per manufacturer's approval
3. Acoustic (Sound) Door: Door manufacturer's sound dampening core; STC 39 rating per ASTM E90. Provide for all doors indicated on door schedule as Sound Door or Acoustic Door.
4. Lead Lined Door: Particle board (PC-5), stave lumber (SLC-5) or structural composite lumber (SCLC-5) core with continuous lead sheets from edge to edge located in center of door.

B. Moldings: Trim louver and glass openings with recessed bead type wood moldings, species matching door face veneer species. Profiles as selected by the Architect from manufacturer's standard profiles.

1. Glass Lites in Fire Rated Doors: Manufacturer's standard wood-veneered noncombustible beads matching veneer species of door faces and approved for use in doors of fire rating indicated. Include concealed metal glazing clips where required for opening size and fire rating indicated.

E. Louvers: Where scheduled, provide sightproof, fixed, welded, inverted V-shaped blade type, formed of 20 gage cold-rolled steel blades and frames, primed painted finish. ANEMOSTAT Model CHDL-2F, NATIONAL GUARD PRODUCTS Model L-A700-BF, AIR LOUVERS INC. 600 A-1.

2.02 FABRICATION

A. Flush Doors: Fabricate doors in accordance with WDMA I.S. 1A, [Premium with Grade AA faces] [Premium with Grade A faces] [Custom with Grade A faces] Grade requirements for transparent stained finish. Formaldehyde free.

1. Core Construction: Bond stiles and rails to core and sand entire unit prior to assembly of face veneers.
2. Number of Plies: 5.
3. Face Veneers: Minimum 1/50" thick before sanding, plain sliced red oak hardwood.
   a. Veneer Figure: Biological defects of grain, color and effects

including but not limited to - blisters, flake, quilts, rope, burl, crotch, mottle patterns, shall not exceed approved veneer samples.

4. Door Thickness: 1-3/4" thick.
5. Adhesive: Type I, waterproof.
6. Edge Strips: Stile edges hardwood species matching face veneer; bonded to core; 1-1/8" minimum width after trimming. Top and bottom edges hardwood of mill option.
7. Match Between Veneer Leaves:
   a. Plain Sliced Veneer: Book matched for color and grain.
   b. Rift or Quarter Sawn Veneer: Slip match for color and grain.
8. Assembly of Veneer Leaves on Door Faces: Running match.
9. Hardware: Factory machine for mortise hardware using template provided by hardware manufacturer.
10. Reinforcement: Reinforce doors to receive hardware specified.
    a. Hinge Attachment: Stiles and rails to be continuously glue bonded to the core so that screw stress is transmitted directly to the core.
    b. Closure, Exit Device and Other Surface Mounted Hardware: Provide top rail 2-1/2" or more in width to hold closer fasteners and solid wood blocking for all other surface applied hardware.

B. Fire Rated Doors: Conform to "Flush Door" requirements specified above. Provide doors of U.L. classification indicated.

1. Reinforcement: Reinforce doors to receive hardware specified.
   a. Surface applied hardware that is located where screws cannot penetrate the above mentioned stiles or wood rails shall be through bolted.

C. Stile and Rail Wood Doors: Fabricate doors in accordance with WDMA "Premium Grade" requirements for transparent stained finish. Formaldehyde free.

1. Stiles: Hardwood laminated stave core.
2. Rails: Solid hardwood core.
3. Joints: Hardwood doweled and glued.
4. Face Veneers: Minimum 1/50" thick before sanding, plain sliced Grade A red oak hardwood. Book matched.
5. Door Thickness: 1-3/4" thick.
6. Adhesive: Type I, waterproof.
7. Edge Strips: Stile edges hardwood species matching face veneer; bonded to core; 1-1/8" minimum width after trimming. Top and bottom edges hardwood of mill option.
8. Hardware: Factory machine for mortise hardware using template provided by hardware manufacturer.
9. Panels: Mitered rim; tongue and grooved; hardwood veneer.
10. Moldings: Trim glass openings with recessed bead type wood moldings, species matching door face veneer species. Profile as selected by Architect.

D. Lead Lined Doors: Conform to applicable requirements of “Flush Door” specified

herein and the following:

1. Type: Premium quality; solid core (stave lumber), lead under veneer design. Provide two continuous lead sheets for a total thickness of 1/8”.
2. Lead: Fed. Spec. QQ-L-201F, Grade C; 99.97% pure.
3. Adhesive: Type recommended by door manufacturer to bond core, lead, cross banding and veneer in one application.

E. Factory Finish

1. General: Comply with referenced quality standard for factory finishing. Complete fabrication, including fitting doors for openings and machining for hardware that is not surface applied, before finishing.
   a. Finish faces, all four edges, edges of cutouts, and mortises. Stains and fillers may be omitted on top and bottom edges, edges of cutouts, and mortises.
2. Finish: WDMA TR-4 conversion varnish.
3. Staining: Color as selected by Architect.
4. Effect: Filled finish.
5. Sheen: Satin.

F. Individually package doors at factory with manufacturer's standard packaging or wrapping for delivery to job site.

G. Manufacturers: MASONITE; EGGERS - VT INDUSTRIES, OSHKOSH; LAMBTON DOORS.

1. Stile and Rail Doors: Above listed manufacturers.

PART 3 EXECUTION

3.01 INSPECTION

A. Examine substances, rough openings and installation conditions. Do not proceed with wood door installation until unsatisfactory conditions have been corrected.

B. Installation constitutes acceptance of existing conditions and responsibility for satisfactory performance.

3.02 PREPARATION

A. Verify metal frame dimensions and hardware mortises in metal frames with metal frame manufacturer.

3.03 INSTALLATION

A. Condition doors to average prevailing humidity in installation area before hanging.

B. Install doors in accordance with manufacturer's installation instructions. Job fit and

prepare doors to receive hardware. Bevel 1/8" in 2" at strike edges for clearance in arc of swing. Seal cut surfaces, tops, bottoms and edges with sanding sealer after fitting and machining.

C. Hang doors straight, plumb and square securely anchored into position. Adjust doors to provide uniform clearance and to contact stops uniformly. Remove and replace doors that are warped, bowed or otherwise damaged and cannot be properly fit to the opening.

D. Install fire-rated doors in corresponding fire-rated frames in accordance with requirements of NFPA No. 80.

3.04 PROTECTION

A. Protect installed doors from soiling, staining and damage until final acceptance.

B. Repair or replace doors damaged beyond acceptable repair as directed by the Architect.

END OF SECTION

SECTION 08 31 00

ACCESS DOORS AND PANELS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Wall access door and frame units.

B. Ceiling access door and frame units.

1.02 RELATED REQUIREMENTS

A. Section [_____]: Openings in partitions.

B. Section [_____]: Openings in ceilings.

C. Section 23 3300 - Air Duct Accessories: Access doors in ductwork.

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide sizes, types, finishes, hardware, scheduled locations, and details of adjoining work.

C. Shop Drawings: Indicate exact position of each access door and/or panel unit.

D. Project Record Documents: Record actual locations of each access unit.

PART 2 PRODUCTS

2.01 ACCESS DOORS AND PANELS ASSEMBLIES

A. Wall-Mounted Units:
   1. Material: Steel.
   2. Door/Panel: Hinged, standard duty, with tool-operated spring or cam lock and no handle.
   3. Tool-operated spring or cam lock; no handle.
   4. Wall-Mounted Units in Wet Areas:
      a. Material: Steel, hot-dipped zinc, or zinc-aluminum-alloy coated.
      b. Door/Panel: Hinged, standard duty, with tool-operated spring or cam lock and no handle.
      c. Tool-operated spring or cam lock; no handle.
   5. Fire-Rated Wall-Mounted Units:
      a. Material: Steel.
      b. Door/Panel: Insulated double-surface panel, with tool-operated spring or cam lock and no handle.
      c. Tool-operated spring or cam lock; no handle.
   6. Ceiling-Mounted Units:
      a. Material: Steel.
      b. Door/Panel: Hinged, standard duty, with tool-operated spring or cam lock and no handle.
      c. Tool-operated spring or cam lock; no handle.
   7. Fire-Rated Ceiling-Mounted Units:
      a. Material: Steel.

b. Door/Panel: Hinged, standard duty, with tool-operated spring or cam lock and no handle.
c. Tool-operated spring or cam lock; no handle.

8. Wall-Mounted Security Units:
   a. Material: Steel.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install units in accordance with manufacturer's instructions.

B. Install frames plumb and level in openings, and secure units rigidly in place.

C. Position units to provide convenient access to concealed equipment when necessary.

END OF SECTION

SECTION 08 42 29

AUTOMATIC SLIDING ENTRANCES

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the contract, including general and supplementary conditions and division 1 specification sections, apply to this section.

1.02 SUMMARY

A. This Section includes the following types of automatic entrances:
   1. Exterior and interior, bi-parting, sliding automatic entrances
   2. Interior entrances include access control locking.

B. Related Sections:
   1. Division 7 Sections for caulking to the extent not specified in this section.
   2. Division 8 Section "Aluminum-Framed Entrances and Storefronts" for entrances furnished and installed separately in Division 8 Section.
   3. Division 8 Section "Door Hardware" for hardware to the extent not specified in this Section.
   4. Division 8 Section Glazing for materials and installation requirements of glazing for automatic entrances.
   5. Division 26 Sections for electrical connections provided separately in Division 26 including conduit and wiring for power to, and monitoring of, and control of, sliding automatic entrances.
   6. Division 28 Section “Electronic Safety and Security” for systems not specified in this section.

1.03 REFERENCES

A. General: Standards listed by reference, including revisions by issuing authority, form a part of this specification section to extent indicated. Standards listed are identified by issuing authority, authority abbreviation, designation number, title or other designation established by issuing authority. Standards subsequently referenced herein are referred to by issuing authority abbreviation and standard designation.

B. Underwriters Laboratories (UL):
   1. UL 325 – Standard for Door, Drapery, Gate, Louver, and Window Operators and Systems.

C. American National Standards Institute (ANSI) / Builders’ Hardware Manufacturers Association (BHMA):
   1. ANSI/BHMA A156.10: Standard for Power Operated Pedestrian Doors.
   2. ANSI/BHMA A156.5: Standard for Auxiliary Locks and Associated Products

D. American Society for Testing and Materials (ASTM):
   1. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
   2. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate

E. American Association of Automatic Door Manufacturers (AAADM):

F. National Fire Protection Association (NFPA):
   1. NFPA 101 – Life Safety Code.
   2. NFPA 70 – National Electric Code.

G. International Code Council (ICC):
   1. IBC: International Building Code

H. Building Officials and Code Administrators International (BOCA), 1999:

I. International Organization for Standardization (ISO):
   1. ISO 9001 - Quality Management Systems

J. National Association of Architectural Metal Manufacturers (NAAMM):
   1. Metal Finishes Manual for Architectural and Metal Products.

K. American Architectural Manufacturers Association (AAMA):
   1. AAMA 2605 – Superior Performing Organic Coatings on Aluminum Extrusions and Panels.
   2. AAMA 701 Voluntary Specification for Pile Weatherstripping and Replaceable Fenestration Weatherseals.

1.04 DEFINITIONS

A. Activation Device: Device that, when actuated, sends an electrical signal to the door operator to open the door.

B. Safety Device: Device that prevents a door from opening or closing, as appropriate.

1.05 PERFORMANCE REQUIREMENTS

A. General: Provide automatic entrance door assemblies capable of withstanding loads and thermal movements based on testing manufacturer's standard units in assemblies similar to those indicated for this Project.

B. Thermal Movements: Provide automatic entrances that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
   1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

C. Operating Range: Minus 30 deg F (Minus 34 deg C) to 130 deg F (54 deg C).

D. Opening-Force Requirements for Egress Doors: Not more than 50 lbf (222 N) required to manually set door in motion if power fails, and not more than 15 lbf (67 N) required to open door to minimum required width.

E. Closing-Force Requirements: Not more than 30 lbf (133 N) required to prevent door from closing.

F. Sliding automatic entrances specified with access control locking shall be designed to function as follows when set for secure operation:
   1. Entrances shall be normally closed and locked by access control locking system with exterior motion activation system disabled. Interior motion activation system to remain enabled; free egress.

2. Upon signal from exterior secure activation device, sliding automatic entrances will unlock and open enabling motion activation system. Entrance will be held open as long as an object or pedestrian remains in the activation or safety zones.
3. Once all activation and safety zones have cleared the entrance will close and re- lock, returning to normal state.
4. At any time during the cycle emergency egress can be achieved by utilizing the emergency breakaway feature.

1.06 SUBMITTALS

A. General: Submit the following in accordance with Conditions of the Contract and Division 1 Specification Sections.

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

C. Color Samples for selection of factory-applied color finishes.

D. Closeout Submittals:

1. Owner’s Manual.
2. Warranties.

1.07 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized representative, with certificate issued by AAADM, who is trained for installation and maintenance of units required for this Project.

B. Manufacturer Qualifications: A qualified manufacturer with a manufacturing facility certified under ISO 9001.

C. Manufacturer shall have in place a national service dispatch center providing 24 hours a day, 7 days a week, emergency call back service.

D. Certifications: Automatic sliding door systems shall be certified by the manufacturer to meet performance design criteria in accordance with the following standards:

1. ANSI/BHMA A156.10.
2. NFPA 101.
3. UL 325 listed.
4. IBC 2009
5. BOCA

E. Source Limitations: Obtain automatic entrance door assemblies through one source from a single manufacturer.

F. Product Options: Drawings indicate sizes, profiles, and dimensional requirements of automatic entrance door assemblies and are based on the specific system indicated. Refer to Division 1 Section "Product Requirements."

G. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

H. Emergency-Exit Door Requirements: Comply with requirements of authorities having jurisdiction for automatic entrances serving as a required means of egress.

1.08 PROJECT CONDITIONS

A. Field Measurements: General Contractor shall verify openings to receive automatic entrance door assemblies by field measurements before fabrication and indicate measurements on Shop Drawings.

B. Mounting Surfaces: General Contractor shall verify all surfaces to be plumb, straight and secure; substrates to be of proper dimension and material.

C. Other trades: General Contractor shall advise of any inadequate conditions or equipment.

1.09 COORDINATION

A. Templates: Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing automatic entrances to comply with indicated requirements.

B. Electrical System Roughing-in: Coordinate layout and installation of automatic entrance door assemblies with connections to power supplies, remote activation devices, remote monitoring systems, and security access control system. See Division 28 Section “Electronic Safety and Security” for systems not provided under this section.

C. System Integration: Integrate sliding automatic entrances with other systems as required for a complete working installation.
   1. Provide electrical interface control capability for activation of sliding automatic entrances by security access system on doors with electric locking.
   2. Provide electrical interface to allow for remote monitoring of automatic entrance door panel status.

1.10 WARRANTY

A. Automatic Entrances shall be free of defects in material and workmanship for a period of two (2) years from the date of substantial completion.

B. During the warranty period the Owner shall engage a factory-trained technician to perform service and affect repairs. A safety inspection shall be performed after each adjustment or repair and a completed inspection form shall be submitted to the Owner.

C. During the warranty period all warranty work, including but not limited to emergency service, shall be performed during normal working hours.

PART 2 PRODUCTS

2.01 AUTOMATIC ENTRANCES

A. Manufacturer: Basis of design is STanley Access Technologies; Dura-Glide 2000 Series sliding automatic entrances.

B. Substitutions: Subject to compliance with requirements of the contract documents, the following named products may be substituted on this project:
   1. Horton HD-Slide Series 2001 Belt Drive.
   2. Besam SL500 FSL.
   3. Record USA; 5100 series: www.record-usa.com

2.02 MATERIALS

A. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.

1. Headers, stiles, rails, and frames: 6063-T6, 6063-T5.
2. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221.
3. Sheet and Plate: ASTM B 209.

B. Sealants and Joint Fillers: Performed under Division 7 Section "Joint Sealants".

2.03 AUTOMATIC ENTRANCE DOOR ASSEMBLIES

A. General: Provide manufacturer's standard automatic entrance door assemblies including doors, sidelights, framing, headers, carrier assemblies, roller tracks, door operators, activation and safety devices, and accessories required for a complete installation.

B. Sliding Automatic Entrances:
1. Configuration: Two sliding leaves and two full sidelights; bi-parting.
2. Traffic Pattern: Two-way.
3. Emergency Breakaway Capability: Sliding leaves only.
4. Mounting: Between jambs.

2.04 COMPONENTS

A. Framing Members: Manufacturer's standard extruded aluminum reinforced as required to support imposed loads.
1. Nominal Size: 1 3/4 inch by 4 1/2 inch (45 by 115 mm).
2. Concealed Fastening: Framing shall incorporate a concealed fastening pocket, and continuous flush insert cover, extending full length of each framing member.

B. Stile and Rail Doors and Sidelights: Manufacturer's standard 1 ¾ inch (45 mm) thick glazed doors with extruded-aluminum tubular stile and rail members. Incorporate concealed tie-rods that span full length of top and bottom rails or mechanically fasten corners with reinforcing brackets that are welded.
1. Glazing Stops and Gaskets: Snap-on, extruded-security aluminum stops and preformed gaskets.
2. Stile Design: Medium stile; 3 ½ inch (95 mm) nominal width.
3. Bottom Rail Design: Minimum 4 inch (102 mm) nominal height.
4. Muntin Bars: Horizontal tubular rail member for each door; 4 1/4 inch (108 mm) to 6 inch (152 mm) nominal width.

C. Glazing: Furnished under Division 8 Section Glazing. All Glazing furnished under separate section shall be as follows:
1. Interior Entrances: 1/4 inch (6 mm) tempered.
2. Exterior Entrances: 1 inch (25 mm) insulated glazing units, hermetically sealed; except at vestibules the exterior entrance shall be 1/4" tempered.

D. Headers: Fabricated from extruded aluminum and extending full width of automatic entrance door units to conceal door operators, carrier assemblies, and roller tracks. Provide hinged or removable access panels for service and adjustment of door operators and controls. Secure panels to prevent unauthorized access.
1. Mounting: Concealed, with one side of header flush with framing.
2. Capacity: Capable of supporting up to 220 lb (100 kg) per panel, up to four panels, over spans up to 14 feet (4.3 m) without intermediate supports.

E. Carrier Assemblies and Overhead Roller Tracks: Manufacturer's standard carrier assembly that allows vertical adjustment of at least 1/8 inch (3 mm); consisting of urethane with precision steel lubricated ball-bearing wheels, operating on a continuous roller track. Support panels from carrier assembly by load wheels and anti-riser wheels with factory adjusted cantilever and pivot assembly. Minimum two ball-bearing load wheels and two anti-rise rollers for each active leaf.

F. Thresholds: Manufacturer's standard thresholds as indicated below:
   1. Exterior Entrances: Continuous standard tapered extrusion square by bevel, with bevel to exterior.
   2. Interior Entrances: Continuous extrusion with taper / square edge coordinated with proposed floor finishes.
   3. All thresholds to conform to details and requirements for code compliance.

G. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, non-staining, non-bleeding fasteners and accessories compatible with adjacent materials.

H. Signage: Provide signage in accordance with ANSI/BHMA A156.10.

2.05 DOOR OPERATORS

A. General: Provide door operators of size recommended by manufacturer for door size, weight, and movement; for condition of exposure; and for long-term, operation under normal traffic load for type of occupancy indicated.

B. Electromechanical Operators: Self-contained overhead unit powered by a fractional horsepower, permanent-magnet DC motor with gear reduction drive, microprocessor controller; and encoder.
   1. Operation: Power opening and power closing.
   2. Features:
      a. Adjustable opening and closing speeds.
      b. Adjustable back-check and latching.
      c. Adjustable braking.
      d. Adjustable hold-open time between 0 and 30 seconds.
      e. Obstruction recycle.
      f. On/Off switch to control electric power to operator.
      g. Energy conservation switch that reduces door-opening width.
      h. Onboard sensor monitoring.
      i. Optional Switch to open/Switch to close operation.
   3. Mounting: Concealed.
   4. Drive System: Synchronous belt type.

C. Electrical service to door operators shall be provided under Division 16 Electrical. Minimum service to be 120 VAC, 5 amps.

2.06 ELECTRICAL CONTROLS

A. Electrical Control System: Electrical control system shall include a microprocessor controller and position encoder. The encoder shall monitor revolutions of the operator shaft and send signals to microprocessor controller to define door position and speed. Systems utilizing external magnets and magnetic switches are not acceptable.

B. Performance Data: The microprocessor shall collect and store performance data as follows:

1. Counter: A non-resettable counter to track operating cycles.
2. Event Reporting: Unit shall include event and error recording including number of occurrences of events and errors, and cycle count of most recent events and errors.
3. LED Display: Display presenting the current operating state of the controller.

C. Controller Protection: The microprocessor controller shall incorporate the following features to ensure trouble free operation:
1. Automatic Reset Upon Power Up.
2. Main Fuse Protection.
3. Motor Protection, over-current protection.

D. Soft Start/Stop: A “soft-start” “soft-stop” motor driving circuit shall be provided for smooth normal opening and recycling.

E. Obstruction Recycle: Provide system to recycle the sliding panels when an obstruction is encountered during the closing cycle.

2.07 ACTIVATION AND SAFETY DEVICES

A. Push Plates: Where scheduled, provide 4 1/2 inch (114 mm) square push plates with UL recognized SPDT switch for primary activation of sliding automatic entrances. Face plates and mounting studs shall be stainless steel. Face plates shall be engraved with the international symbol for accessibility and “Push To Open”. Push plates shall be wall mounted in single or double gang electrical boxes and hardwired to door operator controls.
1. Provide push plates at either side of the outer door.

B. Motion Sensors: Motion sensors shall be mounted on each side of door header to detect pedestrians in the activating zone, and to provide a signal to open doors in accordance with ANSI/BHMA A156.10. Units shall be programmable for bi-directional or uni-directional operation and shall incorporate K-band microwave frequency to detect all motion in both directions.

C. Presence Sensors: Presence sensors shall be provided to sense people or objects in the threshold safety zone in accordance with ANSI/BHMA A156.10. Units shall be self- contained, fully adjustable, and shall function accordingly with motion sensors provided. The sensor shall be enabled simultaneously with the door-opening signal and shall emit an elliptical shaped infrared presence zone, centered on the doorway threshold line. Presence sensors shall be capable of selectively retuning to adjust for objects which may enter the safety zone; tuning out, or disregarding, the presence of small nuisance objects and not tuning out large objects regardless of the time the object is present in the safety zone. The door shall close only after all sensors detect a clear surveillance field.

D. Photoelectric Beams: In addition to the threshold sensor include a minimum of two (2) doorway holding beams. Photoelectric beams shall be pulsed infrared type, including sender receiver assemblies for recessed mounting. Beams shall be monitored by electrical controls for faults and shall fail safe.

E. Door entrance intercom system: Where scheduled on the drawings provide interface with the door entrance intercom system coordinating access and security in accordance with the proposed use.

F. Security Card Swipe or Proximity Readers: Where scheduled on the drawings or hardware schedule provide interface with proposed security system entrance readers.
   1. Inner vestibule door shall have a proximity reader control each side of the door.

2.08 HARDWARE

A. General: Provide units in sizes and types recommended by automatic entrance door and hardware manufacturers for entrances and uses indicated.

B. Emergency Breakaway Feature: Provide release hardware that allows panel(s) to swing out in direction of egress to full 90 degrees from any position in sliding mode. Maximum force to open panel shall be 50 lbf (222 N) according to ANSI/BHMA A156.10. Interrupt powered operation of panel operator while in breakaway mode.
   1. Emergency breakaway feature shall include at least one adjustable detent device mounted in the top of each breakaway panel to control panel breakaway force.
   2. Limit Arms: Limit arms shall be provided to control swing of sliding panels on break-out; swing shall not exceed 90 degrees. Limit arms shall be spring loaded to prevent shock, and include adjustable friction damping.

C. Access Control Locking System: Provide access control locking hardware on sliding automatic entrances as follows:
   1. System shall include:
      a. A fail-secure electric solenoid locking device with a self contained solid state electronic control factory mounted inside the header.
      b. Vertical rod exit devices incorporated into the sliding door panels that prevent breakout until rod is released.
   2. When set for secure operation, the automatic sliding entrance(s) shall electrically latch in the closed position preventing door panels from sliding manually, returning the system to its locked status.
   3. During a power interruption:
      a. The solenoid lock shall be engaged, preventing the doors from sliding manually.
      b. Means of egress shall be accomplished by exit device. Exit device shall be concealed vertical rod tamper proof exit device with recessed flush mounted interior release hardware that shall prohibit manual breakout of door(s) from exterior. Flush mounted release hardware shall be concealed within the horizontal muntin bar.
   4. Provide access control locking system on interior entrances; exterior entrances exclude locking.

D. Alarm Contacts: Sliding automatic entrances shall include factory installed integrated alarm contacts which shall provide a closed circuit dry contact for remote monitoring of sliding panel security. Alarm contacts shall be configured to signal forced entry, normal sliding, and emergency breakout conditions.

E. Control Switch: Provide manufacturer’s standard header mounted rocker switches and door position switch to allow for full control of the automatic entrance door. Controls to include, but are not limited to:

1. One-way traffic; secure on entrances with access control locking.
2. Reduced Opening
3. Open/Closed/Automatic

F. Power Switch: Sliding automatic entrances shall be equipped with a two position “On/Off” illuminated rocker switch to control power to the door.

G. Sliding Weather Stripping: Manufacturer's standard replaceable components complying with AAMA 701; made of wool, polypropylene, or nylon woven pile with nylon-fabric or aluminum-strip backing.

H. Weather Sweeps: Manufacturer's standard adjustable nylon brush sweep mounted to underside of door bottom.

2.09 FABRICATION

A. General: Factory fabricates automatic entrance door assembly components to designs, sizes, and thickness indicated and to comply with indicated standards.
   1. Form aluminum shapes before finishing.
   2. Use concealed fasteners to greatest extent possible.
      a. Where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration, use self-locking devices.
      b. Reinforce members as required to receive fastener threads.

B. Framing: Provide automatic entrances as prefabricated assemblies.
   1. Fabricate tubular and channel frame assemblies with manufacturer's standard mechanical or welded joints. Provide sub-frames and reinforcement as required for a complete system to support required loads.
   2. Perform fabrication operations in manner that prevents damage to exposed finish surfaces.
   3. Form profiles that are sharp, straight, and free of defects or deformations.
   4. Prepare components to receive concealed fasteners and anchor and connection devices.
   5. Fabricate components with accurately fitted joints with ends coped or mitered to produce hairline joints free of burrs and distortion.

C. Doors: Factory fabricated and assembled in profiles indicated. Reinforce as required to support imposed loads and for installing hardware.

D. Door Operators: Factory fabricated and installed in headers, including adjusting and testing.

E. Glazing: Fabricate framing with minimum glazing edge clearances for thickness and type of glazing indicated.

F. Hardware: Factory install hardware to the greatest extent possible; remove only as required for final finishing operation and for delivery to and installation at Project site.

2.10 ALUMINUM FINISHES

A. General: Comply with NAAMM Metal Finishes Manual for Architectural and Metal Products for recommendations for applying and designing finishes. Finish designations prefixed by AA comply with system established by Aluminum Association for designing finishes.

B. Superior-Performance Organic Finish: AA-C12C40R1x Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: acid-chromate-fluoride-phosphate conversion coating; Organic Coating.
   1. Fluoropolymer Three-Coat System: Manufacturer's standard three-coat, thermocured system; including but not limited to mica, metallic, and bright white; consisting of inhibitive primer and fluoropolymer color coat, and clear fluoropolymer topcoat, with both color coat and clear topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight.
   2. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with AAMA 2605 and with coating and resin manufacturers' written instructions.
   3. Minimum dry film thickness shall be 1.2 mils.
   4. Color and Gloss: As selected by Architect from manufacturer's standard colors and gloss for paint system specified.

PART 3 EXECUTION

3.01 INSPECTION

A. Examine conditions for compliance with requirements for installation tolerances, header support, and other conditions affecting performance of automatic entrances. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. General: Do not install damaged components. Fit frame joints to produce joints free of burrs and distortion. Rigidly secure non-movement joints.

B. Entrances: Install automatic entrances plumb and true in alignment with established lines and grades without warp or rack of framing members and doors. Anchor securely in place.
   1. Install surface-mounted hardware using concealed fasteners to greatest extent possible.
   2. Set headers, carrier assemblies, tracks, operating brackets, and guides level and true to location with anchorage for permanent support.

C. Door Operators: Connect door operators to electrical power distribution system as specified in Division 16 Sections.

D. Glazing: Performed under Division 8 Section "Glazing" in accordance with sliding automatic entrance manufacturer's instructions.

E. Sealants: Comply with requirements specified in Division7 Section "Joint Sealants" to provide weather tight installation.

3.03 FIELD QUALITY CONTROL

A. Testing Services: Factory Trained Installer shall test and inspect each automatic entrance door to determine compliance of installed systems with applicable ANSI standards.

3.04 ADJUSTING

A. Adjust door operators, controls, and hardware for smooth and safe operation, for tight closure, and complying with requirements in ANSI/BHMA A156.10.

3.05 CLEANING AND PROTECTION

A. Clean glass and aluminum surfaces promptly after installation. Remove excess

glazing and sealant compounds, dirt, and other substances. Repair damaged finish to match original finish. Comply with requirements in Division 8 Section “Glazing”, for cleaning and maintaining glass.

END OF SECTION

SECTION 08 53 13

VINYL WINDOWS

PART 1 GENERAL

1.01 SCOPE

A. Provide exterior single hung vinyl windows and transoms. Work includes:

1. Matching picture (fixed) units.
2. Glass and glazing of the various window systems.
3. Brickmolds, extensions and trim for complete installation.
2. Anchors, fasteners, flashings and accessories to complete the work.

1.02 RELATED SECTIONS

A. Sealant: Section 07 92 00.

B. Glazing: Section 08 81 00.

C. Alternates: Section 01 23 00

1.03 QUALITY ASSURANCE

A. Standards: Comply with the applicable provisions of American Architectural Manufacturers Association (AAMA) "Voluntary Specifications for Aluminum and Poly (Vinyl Chloride) (PVC) Prime Windows and Glass Doors, AAMA 101".

B. Reference Standards: Wherever the following abbreviations are shown herein, they shall refer to the corresponding standard:

1. AAMA: American Architectural Manufacturers Association.
2. ASTM: American Society for Testing and Materials.

D. Manufacturer: Current member of the American Architectural Manufacturers Association

E. Installer Qualifications: An installer acceptable to aluminum window manufacturer for installation of units required for this Project, not less than five (5) years of successful experience with a minimum of 5 projects similar in scope and complexity to this project.

1. When requested by Owner, provide a list the referenced projects. Include project name, Owner, Architect, Contractor, Installer and product references.

F. Certification: All units to be Energy Star rated.

1.04 MOCKUP INSTALLATION

A. Provide window mockup installation to determine acceptability of installation methods and coordination with adjoining materials. Adjustments may be required by the Architect for compliance with the intent of the Contract Documents.

B. Once the approval process is complete, the approved sample installation, modified as needed, will represent minimum installation quality for the work.

C. Coordinate with masonry sample panel. See specification section 04 00 00.

1.05 SUBMITTALS

A. Submit the following:

1. Submit manufacturer's product data and installation instructions. Submit shop drawings for fabrication and installation of aluminum windows. Include elevations and detail sections of every typical member. Show anchors, joints, expansion provisions, and other elements not included in manufacturer's standard data. Include glazing details.
2. Submit finish samples.

1.06 DELIVERY, STORAGE AND HANDLING

A. Deliver materials to job site in sealed, undamaged cartons.

B. Comply with manufacturer's written requirements for storage and handling of units.

C. Store off ground, under cover, protected from weather and construction activities.

1.07 WARRANTY

A. Warranty for all work in this Section to operate properly and be weathertight for the standard manufacturer’s warranty.

B. Provide Contractor's guarantee for all work under this Section to be free from defects of workmanship for a period on one year.

PART 2 PRODUCTS

2.01 DOUBLE HUNG WINDOW

A. Manufacturer: Drawings and specifications are based on Pinnacle Series 8000 double hung windows by LINDSAY. Windows by other manufacturers must be approved by the Owner, through the Architect, during bidding. Approval process includes submission of product data, catalog cuts, design information and, where

requested, a full size sample.

B. Testing and Performance Requirements

1. Conformance to LC-PG30 specifications in AAMA/WDMA/CSA 101/I.S.2/A440-05 when tests are performed on the prescribed size.
    a. Air infiltration (air leakage) shall not exceed the following when tested at 1.57 psf when tested in accordance with ASTM E283: 0.30 cfm per square foot of frame.b. Water penetration resistance - There shall be no water penetration when tested at the specified pressure in accordance with ASTM E547. LC-PG30 5.25 psf
    b. Single Hung mull/stack configurations must withstand the following positive/negative structural test pressure without damage when tested according to ASTM E330: +67.7/-67.7
2. Thermal testing per AAMA 1503-98, at the prescribed 48" x 72" test size glazed with 1” insulating glass made with exterior 1/8” clear glass, argon gas, and interior 1/8” low E glass, with the following test results:
    a. Condensation Resistance Factor: minimum 54 frame and 60 glass CRF.
    b. Thermal Transmittance: maximum .37 BTU/HR/SQ.FT/°F U value.

C. Frame and Window

1. Member: 3 ¼” main frame depth and window members designed specifically for manufacturers of vinyl windows using hollow extrusions of rigid PVC.
2. Main Frame Corners: Welded construction.
3. Glazing: Extruded PVC bead. Units to accept 3/4 inch thick insulating glass.
4. Simulated Divided Lites: Extruded vinyl contoured muntin permanently applied to exterior and interior of insulating glass unit.

D. Hardware

1. Sash Balance: Constant force springs or similar type as approved by Architect.
2. Locks: Cam-type on each operable sash.
3. Screws, Clips and Other Fasteners: Manufacturer's standard non-corrosive type materials compatible with aluminum.
4. Weatherstripping: Provide fin pile around entire perimeter of all ventilators.
5. Screen Material: Charcoal Fiberglass screen cloth (18 by 16 mesh) set in painted roll formed aluminum frame.
6. Limits: limit devices designed to restrict sash opening.
    a. Limit clear opening to 3 3/4” inches for ventilation; with custodial key release.

E. Color: Black exterior, white interior. AAMA 615 10 year color retention.

2.02 GLAZING

A. General: Comply with specification 08 81 00. Low E coated clear insulated, preassembled units consisting of organically sealed panes of glass enclosing a hermetically sealed dehydrated air space and complying with ASTM E774 for performance classification indicated as well as with other requirements specified for thermal glass characteristics, air space, sealing system, sealant, spacer material, corner design and desiccant.

B. Glass Type: Type I, Class 1 for clear glass, Quality q^3, conforming to ASTM C1036. Provide tempered at operating units and where required by codes.

C. Performance:

1. Solar Heat Gain Coefficient: 0.30
2. U Factor: 0.31

PART 3 EXECUTION

3.01 INSPECTION

A. Examine substrates, supporting structure and installation conditions. Do not proceed with window or door erection until unsatisfactory conditions have been corrected.

B. Installation constitutes acceptance of existing conditions and responsibility for satisfactory performance.

3.02 INSTALLATION

A. General

1. Do not install component parts which are observed to be defective, including warped, bowed, dented, abraded, and broken members. Remove and replace members which have been damaged during installation or thereafter before time of acceptance.
2. Do not cut or trim component parts during erection, in a manner which would damage finish, decrease strength or result in a visual imperfection of a failure in performance of the work.

B. Install windows and doors in accordance with the manufacturer's instructions and recommendations for the installation of window components.

C. Install component parts level, plumb, true to line and with uniform joints and reveals. Secure to structure with non-staining and non-corrosive shims, anchors, fasteners, spacers and fillers. Use erection equipment which will not mar or stain finished surfaces, and will not damage component parts.

D. Assembly and Anchorage: Anchor component parts securely in place by bolting or

other permanent mechanical attachment system which will comply with performance requirements and permit movements as required.

E. Set sill members in a bed of sealant compound or with joint fillers or gaskets to provide weathertight requirements. Do not seal drainage holes (slots).

3.03 CLEANING AND PROTECTION

A. Protect glass from breakage immediately upon installation, by attachment of streamers to framing held away from glass.

1. Do not apply markings of any type on surfaces ofglass.

B. Immediately before acceptance of the work, clean the window thoroughly, inside and out.

END OF SECTION

SECTION 08 71 00

DOOR HARDWARE

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section includes:

1. Mechanical and electrified door hardware for:

a. Swinging doors.

2. Electronic access control system components, including:

a. Electronic access control devices.

3. The intent of the hardware specification is to specify the hardware for interior and exterior doors, and to establish a type, continuity, and standard of quality. However, it is the door hardware supplier's responsibility to thoroughly review existing conditions, schedules, specifications, drawings, and other Contract Documents to verify the suitability of the hardware specified.

B. Exclusions: Unless specifically listed in hardware sets, hardware is not specified in this section for:

1. Windows
2. Cabinets (casework), including locks in cabinets
3. Signage
4. Toilet accessories
5. Overhead doors

C. Related Sections:

1. Division 01 Section "Alternates" for alternates affecting this section.
2. Division 07 Section "Joint Sealants" for sealant requirements applicable to threshold installation specified in this section.
3. Division 26 sections for connections to electrical power system and for low-voltage wiring.
4. Division 28 sections for coordination with other components of electronic access control system.

1.03 REFERENCES

A. UL - Underwriters Laboratories

1. UL 10B - Fire Test of Door Assemblies
2. UL 10C - Positive Pressure Test of Fire Door Assemblies
3. UL 1784 - Air Leakage Tests of Door Assemblies
4. UL 305 - Panic Hardware

B. DHI - Door and Hardware Institute

1. Sequence and Format for the Hardware Schedule
2. Recommended Locations for Builders Hardware
3. Key Systems and Nomenclature

C. ANSI - American National Standards Institute

1. ANSI/BHMA A156.1 - A156.29, and ANSI/BHMA A156.31 - Standards for Hardware and Specialties

1.04 SUBMITTALS

A. General:

1. Submit in accordance with Conditions of Contract and Division 01 requirements.
2. Highlight, encircle, or otherwise specifically identify on submittals deviations from Contract Documents, issues of incompatibility or other issues which may detrimentally affect the Work.
3. Prior to forwarding submittal, comply with procedures for verifying existing door and frame compatibility for new hardware, as specified in PART 3, “EXAMINATION” article, herein.

B. Action Submittals:

1. Product Data: Technical product data for each item of door hardware, installation instructions, maintenance of operating parts and finish, and other information necessary to show compliance with requirements.
2. Riser and Wiring Diagrams: After final approval of hardware schedule, submit details of electrified door hardware, indicating:

    a. Wiring Diagrams: For power, signal, and control wiring and including:
        1) Details of interface of electrified door hardware and building safety and security systems.
        2) Schematic diagram of systems that interface with electrified door hardware.
        3) Point-to-point wiring.
        4) Risers.

3. Samples for Verification: If requested by Architect, submit production sample of requested door hardware unit in finish indicated, and tagged with full description for coordination with schedule.

a. Samples will be returned to supplier. Units that are acceptable to Architect may, after final check of operations, be incorporated into Work, within limitations of key coordination requirements.

4. Door Hardware Schedule: Submit schedule with hardware sets in vertical format as illustrated by Sequence of Format for the Hardware Schedule as published by the Door and Hardware Institute. Indicate complete designations of each item required for each door or opening, include:
   a. Door Index; include door number, heading number, and Architects hardware set number.
   b. Opening Lock Function Spreadsheet: List locking device and function for each opening.
   c. Quantity, type, style, function, size, and finish of each hardware item.
   d. Name and manufacturer of each item.
   e. Fastenings and other pertinent information.
   f. Location of each hardware set cross-referenced to indications on Drawings.
   g. Explanation of all abbreviations, symbols, and codes contained in schedule.
   h. Mounting locations for hardware.
   i. Door and frame sizes and materials.
   j. Name and phone number for local manufacturer's representative for each product.
   k. Operational Description of openings with any electrified hardware (locks, exits, electromagnetic locks, electric strikes, automatic operators, door position switches, magnetic holders or closer/holder units, and access control components). Operational description should include operational descriptions for: egress, ingress (access), and fire/smoke alarm connections.
      1) Submittal Sequence: Submit door hardware schedule concurrent with submissions of Product Data, Samples, and Shop Drawings. Coordinate submission of door hardware schedule with scheduling requirements of other work to facilitate fabrication of other work that is critical in Project construction schedule.

5. Key Schedule:

   a. After Keying Conference, provide keying schedule listing levels of keying as well as explanation of key system's function, key symbols used and door numbers controlled.
   b. Use ANSI/BHMA A156.28 “Recommended Practices for Keying Systems” as guideline for nomenclature, definitions, and approach for selecting optimal keying system.
   c. Provide 3 copies of keying schedule for review prepared and detailed in accordance with referenced DHI publication. Include schematic keying diagram and index each key to unique door designations.
   d. Index keying schedule by door number, keyset, hardware heading number, cross keying instructions, and special key stamping instructions.
   e. Provide one complete bitting list of key cuts and one key system schematic illustrating system usage and expansion.
      1) Forward bitting list, key cuts and key system schematic directly to Owner, by means as directed by Owner.
   f. Prepare key schedule by or under supervision of supplier, detailing

Owner's final keying instructions for locks.

6. Templates: After final approval of hardware schedule, provide templates for doors, frames and other work specified to be factory or shop prepared for door hardware installation.

C. Informational Submittals:

1. Qualification Data: For Supplier, Installer and Architectural Hardware Consultant.
2. Product data for electrified door hardware:

   a. Certify that door hardware approved for use on types and sizes of labeled fire-rated doors complies with listed fire-rated door assemblies.

3. Warranty: Special warranty specified in this Section.

D. Closeout Submittals:

1. Operations and Maintenance Data: Provide in accordance with Division 01 and include:

   a. Complete information on care, maintenance, and adjustment; data on repair and replacement parts, and information on preservation of finishes.
   b. Catalog pages for each product.
   c. Factory order acknowledgement numbers (for warranty and service)
   d. Name, address, and phone number of local representative for each manufacturer.
   e. Parts list for each product.
   f. Final approved hardware schedule, edited to reflect conditions as-installed.
   g. Final keying schedule
   h. Copies of floor plans with keying nomenclature
   i. As-installed wiring diagrams for each opening connected to power, both low voltage and 110 volts.
   j. Copy of warranties including appropriate reference numbers for manufacturers to identify project.

1.05 QUALITY ASSURANCE

A. Supplier Qualifications and Responsibilities: Recognized architectural hardware supplier with record of successful in-service performance for supplying door hardware similar in quantity, type, and quality to that indicated for this Project and that provides certified Architectural Hardware Consultant (AHC) or Door Hardware Consultant (DHC) available to Owner, Architect, and Contractor, at reasonable times during the Work for consultation.

1. Warehousing Facilities: In Project's vicinity.
2. Scheduling Responsibility: Preparation of door hardware and keying schedules.
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.

4. Coordination Responsibility: Assist in coordinating installation of electronic security hardware with Architect and electrical engineers and provide installation and technical data to Architect and other related subcontractors.

    a. Upon completion of electronic security hardware installation, inspect and verify that all components are working properly.

B. Architectural Hardware Consultant Qualifications: Person who is experienced in providing consulting services for door hardware installations that are comparable in material, design, and extent to that indicated for this Project and meets these requirements:

    1. For door hardware, DHI-certified, Architectural Hardware Consultant (AHC) or Door Hardware Consultant (DHC).
    2. Can provide installation and technical data to Architect and other related subcontractors.
    3. Can inspect and verify components are in working order upon completion of installation.
    4. Capable of producing wiring diagrams.
    5. Capable of coordinating installation of electrified hardware with Architect and electrical engineers.

C. Single Source Responsibility: Obtain each type of door hardware from single manufacturer.

D. Fire-Rated Door Openings: Provide door hardware for fire-rated openings that complies with NFPA 80 and requirements of authorities having jurisdiction. Provide only items of door hardware that are listed products tested by Underwriters Laboratories, Intertek Testing Services, or other testing and inspecting organizations acceptable to authorities having jurisdiction for use on types and sizes of doors indicated, based on testing at positive pressure and according to NFPA 252 or UL 10C and in compliance with requirements of fire- rated door and door frame labels.

E. Electrified Door Hardware: Listed and labeled as defined in NFPA 70, Article 100, by testing agency acceptable to authorities having jurisdiction.

F. Accessibility Requirements: For door hardware on doors in an accessible route, comply with governing accessibility regulations cited in “REFERENCES” article, herein.

G. Keying Conference

    1. Incorporate keying conference decisions into final keying schedule after reviewing door hardware keying system including:

        a. Function of building, flow of traffic, purpose of each area, degree of security required, and plans for future expansion.
        b. Preliminary key system schematic diagram.
        c. Requirements for key control system.

d. Requirements for access control.
e. Address for delivery of keys.

H. Pre-installation Conference

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. Inspect and discuss preparatory work performed by other trades.
3. Inspect and discuss electrical roughing-in for electrified door hardware.
4. Review sequence of operation for each type of electrified door hardware.
5. Review required testing, inspecting, and certifying procedures.

I. Coordination Conferences:

1. Installation Coordination Conference: Prior to hardware installation, schedule and hold meeting to review questions or concerns related to proper installation and adjustment of door hardware.
2. Electrified Hardware Coordination Conference: Prior to ordering electrified hardware, schedule and hold meeting to coordinate door hardware with security, electrical, doors and frames, and other related suppliers.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Inventory door hardware on receipt and provide secure lock-up for hardware delivered to Project site.

B. Tag each item or package separately with identification coordinated with final door hardware schedule, and include installation instructions, templates, and necessary fasteners with each item or package.

1. Deliver each article of hardware in manufacturer’s original packaging.

C. Project Conditions:

1. Maintain manufacturer-recommended environmental conditions throughout storage and installation periods.
2. Provide secure lock-up for door hardware delivered to Project. Control handling and installation of hardware items so that completion of Work will not be delayed by hardware losses both before and after installation.

D. Protection and Damage:

1. Promptly replace products damaged during shipping.
2. Handle hardware in manner to avoid damage, marring, or scratching. Correct, replace or repair products damaged during Work.
3. Protect products against malfunction due to paint, solvent, cleanser, or any chemical agent.

E. Deliver keys and permanent cores to Owner by registered mail or overnight package service.

1.07 COORDINATION

A. Coordinate layout and installation of floor-recessed door hardware with floor construction. Cast anchoring inserts into concrete.

B. Installation Templates: Distribute for doors, frames, and other work specified to be factory or shop 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.

C. Security: Coordinate installation of door hardware, keying, and access control with Owner's security consultant.

D. Electrical System Roughing-In: Coordinate layout and installation of electrified door hardware with connections to power supplies and building safety and security systems.

1.08 WARRANTY

A. Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Beginning from date of Substantial Completion, for durations indicated.

a. Closers:
1) Mechanical: 10 years.

b. Automatic Operators: 2 years.
c. Exit Devices:
1) Mechanical: 3 years.
2) Electrified: 1 year.

d. Locksets:
1) Mechanical: 3 years.

e. Continuous Hinges: Lifetime warranty.
f. Key Blanks: Lifetime

2. Warranty does not cover damage or faulty operation due to improper installation, improper use or abuse.

1.09 MAINTENANCE

A. Maintenance Tools: Furnish complete set of special tools required for maintenance and adjustment of hardware, including changing of cylinders.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. The Owner requires use of certain products for their unique characteristics and project suitability to insure continuity of existing and future performance and maintenance standards. After investigating available product offerings, the Awarding Authority has elected to prepare proprietary specifications. These products are specified with the notation: “No Substitute.”

1. Where “No Substitute” is noted, submittals and substitution requests for other products will not be considered.

B. Approval of manufacturers and/or products other than those listed as “Scheduled Manufacturer” or “Acceptable Manufacturers” in the individual article for the product category shall be in accordance with QUALITY ASSURANCE article, herein.

C. Approval of products from manufacturers indicated in “Acceptable Manufacturers” is contingent upon those products providing all functions and features and meeting all requirements of scheduled manufacturer’s product.

D. Where specified hardware is not adaptable to finished shape or size of members requiring hardware, furnish suitable types having same operation and quality as type specified, subject to Architect's approval.

2.02 MATERIALS

A. Fasteners

1. Provide hardware manufactured to conform to published templates, generally prepared for machine screw installation.
2. Furnish screws for installation with each hardware item. Finish exposed (exposed under any condition) screws to match hardware finish, or, if exposed in surfaces of other work, to match finish of this other work including prepared for paint surfaces to receive painted finish.
3. Provide concealed fasteners for hardware units exposed when door is closed except when no standard units of type specified are available with concealed fasteners. Do not use thru-bolts for installation where bolt head or nut on opposite face is exposed in other work unless thru-bolts are required to fasten hardware securely. Review door specification and advise Architect if thru-bolts are required.
4. Install hardware with fasteners provided by hardware manufacturer.

B. Modification and Preparation of Existing Doors: Where existing door hardware is indicated to be removed and reinstalled.

1. Provide necessary fillers, Dutchmen, reinforcements, and fasteners, compatible with existing materials, as required for mounting new opening hardware and to cover existing door and frame preparations.
2. Use materials which match materials of adjacent modified areas.
3. When modifying existing fire-rated openings, provide materials permitted by NFPA 80 as required to maintain fire-rating.

C. Provide screws, bolts, expansion shields, drop plates and other devices necessary for hardware installation.

1. Where fasteners are exposed to view: Finish to match adjacent door hardware material.

D. Cable and Connectors: Hardwired Electronic Access Control Lockset and Exit Device Trim:

1. Data: 24AWG, 4 conductor shielded, Belden 9843, 9841 or comparable.
2. DC Power: 18 AWG, 2 conductor, Belden 8760 or comparable.
3. Provide type of data and DC power cabling required by access control device manufacturer for this installation.

2.03 HINGES

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product: Ives 5BB series.
2. Acceptable Manufacturers and Products: Hager BB series, McKinney TA/T4A series.

B. Requirements:

1. Provide hinges conforming to ANSI/BHMA A156.1.
2. 1-3/4 inch (44 mm) thick doors, up to and including 36 inches (914 mm) wide:

a. Exterior: Standard weight, bronze or stainless steel, 4-1/2 inches (114 mm) high
b. Interior: Standard weight, steel, 4-1/2 inches (114 mm) high

3. 1-3/4 inch (44 mm) thick doors over 36 inches (914 mm) wide:

a. Exterior: Heavy weight, bronze/stainless steel, 5 inches (127 mm) high
b. Interior: Heavy weight, steel, 5 inches (127 mm) high

4. 2 inches or thicker doors:

a. Exterior: Heavy weight, bronze or stainless steel, 5 inches (127 mm) high
b. Interior: Heavy weight, steel, 5 inches (127 mm) high

5. Provide three hinges per door leaf for doors 90 inches (2286 mm) or less in height, and one additional hinge for each 30 inches (762 mm) of additional door height.
6. Hinge Pins: Except as otherwise indicated, provide hinge pins as follows:

a. Steel Hinges: Steel pins
b. Non-Ferrous Hinges: Stainless steel pins
c. Out-Swinging Exterior Doors: Non-removable pins
d. Out-Swinging Interior Lockable Doors: Non-removable pins
e. Interior Non-lockable Doors: Non-rising pins

7. Width of hinges: 4-1/2 inches (114 mm) at 1-3/4 inch (44 mm) thick doors, and 5 inches (127 mm) at 2 inches (51 mm) or thicker doors. Adjust hinge width as required for door, frame, and wall conditions to allow proper degree of opening.
8. Provide spring hinges where specified. Provide two spring hinges and one bearing hinge per door leaf for doors 90 inches (2286 mm) or less in height. Provide one additional bearing hinge for each 30 inches (762 mm) of additional door height.

2.04 FLUSH BOLTS

A. Manufacturers:

1. Scheduled Manufacturer: Ives.
2. Acceptable Manufacturers: Burns, Rockwood.

B. Requirements:

1. Provide automatic, constant latching, and manual flush bolts with forged bronze or stainless-steel face plates, extruded brass levers, and with wrought brass guides and strikes. Provide 12 inch (305 mm) steel or brass rods at doors up to 90 inches (2286 mm) in height. For doors over 90 inches (2286 mm) in height increase top rods by 6 inches (152 mm) for each additional 6 inches (152 mm) of door height. Provide dust-proof strikes at each bottom flush bolt.

2.05 LOCKSETS – INTERCONNECTED TYPE

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product: Schlage CS210 series.
2. Acceptable Manufacturers and Products: Falcon H2 series, Yale YH Collection™.

B. Requirements:

1. Provide interlocked locksets conforming to ANSI/BHMA A156.12 Series 5000, Grade 2 with simultaneous retraction of deadbolt and latch for single motion egress. Cylinders: Refer to “KEYING” article, herein.
2. Provide locks with 2-3/8 inches (60 mm) or 2-3/4 inches (70 mm) backset, based on door detail, with 1/2 inch (13 mm) latch throw latchbolt and 1 inch (25 mm) throw deadbolt.
3. Provide independently operating levers with two external return spring cassettes mounted under roses to prevent lever sag.
4. Provide manufacturers standard T-strike, unless extended lip strike is necessary to protect trim, and deadbolt strike.
5. Lever Design: Schlage Jupiter/Jazz.

2.06 CYLINDRICAL LOCKS – GRADE 2

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product: Falcon W series.

2. Acceptable Manufacturers and Products: Best 73KC series, Sargent 6500 series.

B. Requirements:

1. Provide cylindrical locks conforming to ANSI/BHMA A156.2 Series 4000, Grade 2, and UL Listed for 3 hour fire doors.
2. Cylinders: Refer to “KEYING” article, herein.
3. Provide locks with standard 2-3/4 inches (70 mm) backset, unless noted otherwise, with 1/2 inch latch throw. Provide proper latch throw for UL listing at pairs.
4. Provide locksets with separate anti-rotation thru-bolts, and no exposed screws.
5. Provide independently operating levers with two external return spring cassettes mounted under roses to prevent lever sag.
6. Provide standard ASA strikes unless extended lip strikes are necessary to protect trim.
7. Lever Trim: Solid cast levers without plastic inserts and wrought roses on both sides.

a. Lever Design: Falcon Avalon.

2.07 TUBULAR LOCKS – GRADE 2

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product: Schlage F series.
2. Acceptable Manufacturers and Products: Sargent DL series, Yale YH collection.

B. Requirements:

1. Provide tubular locks conforming to ANSI/BHMA A156.2 Series 4000, Grade 2, Grade 2 and ANSI/BHMA A156.39 Residential Grade AAA, and UL Listed for 3 hour fire doors.
2. Cylinders: Refer to “KEYING” article, herein.
3. Provide locks with standard 2-3/8 inches (60 mm) adjustable to 2-3/4 inches (70 mm) backset with 1/2 inch (13 mm) latch throw. Provide 2-3/4 inches (70 mm) backset, unless 2-3/8 inches (60 mm) is required by door or frame detail, or noted otherwise.
4. Provide locksets that fit standard 2-1/8 inches (54 mm) diameter bore without use of thru- bolts.
5. Door Thickness: Locksets adjustable to fit in 1-3/8 inches (35 mm) or 1-3/4 inches (44 mm) door thickness.
6. Provide standard T-strikes unless extended lip strikes are necessary to protect trim.
7. Lever Trim: Solid cast levers without plastic inserts and wrought roses on both sides.

a. Lever Design: Schlage Jazz.

2.08 AUXILIARY LOCKS

A. Deadbolts:

1. Manufacturers and Products:

    a. Scheduled Manufacturer and Product: Schlage B60 Series.
    b. Acceptable Manufacturers and Products: Falcon D100 Series, Sargent 480 Series.

2. Requirements:

    a. Provide deadbolt series conforming to ANSI/BHMA A156 and function as specified.
    b. Cylinders: Refer to “KEYING” article, herein.
    c. Provide deadbolts with standard 2-3/4 inches (70 mm) backset. Provide 2-3/8 inches (60 mm) where noted or if door or frame detail requires. Provide deadbolt with full 1 inch (25 mm) throw, constructed of steel alloy.
    d. Provide manufacturer’s standard strike.

2.09 ELECTRIC STRIKES

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product: Von Duprin 6000 Series.
2. Acceptable Manufacturers and Products: Folger Adam 300 Series, HES 1006 Series.

B. Requirements:

1. Provide electric strikes designed for use with type of locks shown at each opening.
2. Provide electric strikes UL Listed as burglary-resistant.
3. Where required, provide electric strikes UL Listed for fire doors and frames.
4. Provide transformers and rectifiers for each strike as required. Verify voltage with electrical contractor.

2.10 CYLINDERS

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product: Schlage Everest 29 SL.
2. Acceptable Manufacturers and Products: No Substitute.

B. Requirements:

1. Provide cylinders/cores, compliant with ANSI/BHMA A156.5; latest revision; cylinder face finished to match lockset, manufacturer’s series as indicated. Refer to “KEYING” article, herein.
2. Provide cylinders in the below-listed configuration(s), distributed throughout the Project as indicated.

    a. Conventional Patented Restricted 7-Pin: cylinder with permanent 7-pin core with keys capable of working in full size key-in-lever/knob, and small format interchangeable core.

3. Patent Protection: Cylinders/cores requiring use of restricted, patented keys, patent- protected until the year, 2029.
4. Nickel silver bottom pins.

C. Construction Keying:

1. Replaceable Construction Cores.

a. Provide temporary construction cores replaceable by permanent cores, furnished in accordance with the following requirements.
1) 3 construction control keys
2) 12 construction change (day) keys.

b. Owner or Owner's Representative will replace temporary construction cores with permanent cores.

2.11 KEYING

A. Provide a factory registered keying system, complying with guidelines in ANSI/BHMA A156.28, incorporating decisions made at keying conference.

B. Requirements:

1. Provide permanent cylinders/cores keyed by the manufacturer according to the following key system.

a. Master Keying system as directed by the Owner.

2. Forward bitting list and keys separately from cylinders, by means as directed by Owner. Failure to comply with forwarding requirements will be cause for replacement of cylinders/cores involved at no additional cost to Owner.
3. Provide keys with the following features:

a. Material: Nickel silver; minimum thickness of .107-inch (2.3mm)
b. Patent Protection: Keys and blanks protected by one or more utility patent(s)**:** until the year, 2029.
c. Geographically Exclusive: Where High Security or Security cylinders/cores are indicated, provide nationwide, geographically exclusive key system complying with the following restrictions.

4. Identification:

a. Mark permanent cylinders/cores and keys with applicable blind code per DHI publication "Keying Systems and Nomenclature" for identification. Do not provide blind code marks with actual key cuts.
b. Identification stamping provisions must be approved by the Architect and Owner.
c. Stamp cylinders/cores and keys with Owner's unique key system facility code as established by the manufacturer; key symbol and embossed or

stamped with "DO NOT DUPLICATE" along with the "PATENTED" or patent number to enforce the patent protection.
d. Failure to comply with stamping requirements will be cause for replacement of keys involved at no additional cost to Owner.
e. Forward permanent cylinders/cores to Owner, separately from keys, by means as directed by Owner.

5. Quantity: Furnish in the following quantities.

a. Change (Day) Keys: 3 per cylinder/core.
b. Permanent Control Keys: 3.
c. Master Keys: 6.

2.12 KEY CONTROL SYSTEM

A. Manufacturers:

1. Scheduled Manufacturer: Telkee.
2. Acceptable Manufacturers: HPC, Lund.

B. Requirements:

1. Provide key control system, including envelopes, labels, tags with self-locking key clips, receipt forms, 3-way visible card index, temporary markers, permanent markers, and standard metal cabinet, all as recommended by system manufacturer, with capacity for 150% of number of locks required for Project.

a. Provide complete cross index system set up by hardware supplier, and place keys on markers and hooks in cabinet as determined by final key schedule.
b. Provide hinged-panel type cabinet for wall mounting.

2.13 DOOR CLOSERS

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product: Falcon SC70A series.
2. Acceptable Manufacturers and Products: LCN 4050 series, Norton 7500 series, Sargent 351 series.

B. Requirements:

1. Provide door closers conforming to ANSI/BHMA A156.4 Grade 1 requirements by BHMA certified independent testing laboratory. ISO 9000 certify closers. Stamp units with date of manufacture code.
2. Provide door closers with fully hydraulic, full rack and pinion action with aluminum cylinder.
3. Closer Body: 1-1/2 inch (38 mm) diameter with 5/8 inch (16 mm) diameter heat-treated pinion journal.
4. Hydraulic Fluid: Fireproof, passing requirements of UL10C, and requiring no seasonal closer adjustment for temperatures ranging from 120 degrees F to -

30 degrees F.
5. Spring Power: Continuously adjustable over full range of closer sizes, and providing reduced opening force as required by accessibility codes and standards.
6. Hydraulic Regulation: By tamper-proof, non-critical valves, with separate adjustment for latch speed, general speed, and backcheck.
7. Pressure Relief Valve (PRV) Technology: Not permitted.
8. Provide special templates, drop plates, mounting brackets, or adapters for arms as required for details, overhead stops, and other door hardware items interfering with closer mounting.

2.14 DOOR CLOSERS

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product: Falcon SC80A series.
2. Acceptable Manufacturers and Products: LCN 1450 series, Norton 8000 series, Sargent 1331 series.

B. Requirements:

1. Provide door closers conforming to ANSI/BHMA A156.4 Grade 1 requirements by BHMA certified independent testing laboratory.
2. Provide door closers with fully hydraulic, full rack and pinion action with aluminum cylinder.
3. Closer Body: 1-1/4 inch (32 mm) diameter, with 5/8 inch (16 mm) diameter heat-treated pinion journal.
4. Hydraulic Fluid: Fireproof, passing requirements of UL10C, and requiring no seasonal closer adjustment for temperatures ranging from 120 degrees F to -30 degrees F.
5. Spring Power: Continuously adjustable over full range of closer sizes, and providing reduced opening force as required by accessibility codes and standards.
6. Hydraulic Regulation: By tamper-proof, non-critical valves, with separate adjustment for latch speed, general speed, and backcheck.
7. Pressure Relief Valve (PRV) Technology: Not permitted.
8. Provide special templates, drop plates, mounting brackets, or adapters for arms as required for details, overhead stops, and other door hardware items interfering with closer mounting.

2.15 ELECTRO-HYDRAULIC AUTOMATIC OPERATORS

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product: LCN 4600 series.
2. Acceptable Manufacturers and Products: Norton 6000 series, Besam Power Swing.

B. Requirements:

1. Provide low energy automatic operator units with hydraulic closer

complying with ANSI/BHMA A156.19.

2. Hydraulic Fluid: Fireproof, passing requirements of UL10C, and requiring no seasonal closer adjustment for temperatures ranging from 120 degrees F to -30 degrees F.
3. Provide units with conventional door closer opening and closing forces unless power operator motor is activated. Provide door closer assembly with adjustable spring size, back-check, and opening and closing speed adjustment valves to control door
4. Provide units with on/off switch for manual operation, motor start up delay, vestibule interface delay, electric lock delay, and door hold open delay.
5. Provide units with conventional door closer opening and closing forces unless power operator motor is activated. Provide door closer assembly with adjustable spring size, back-check valve, sweep valve, latch valve to control door.
6. Provide drop plates, brackets, or adapters for arms as required for details.
7. Provide hard-wired actuator switches for operation as specified.
8. Provide weather-resistant actuators at exterior applications.
9. Provide key switches with LED's, recommended and approved by manufacturer of automatic operator as required for function described in operation description of hardware group below. Cylinders: Refer to "KEYING" article, herein.
10. Provide complete assemblies of controls, switches, power supplies, relays, and parts/material recommended and approved by manufacturer of automatic operator for each individual leaf. Actuators control both doors simultaneously at pairs. Sequence operation of exterior and vestibule doors with automatic operators to allow ingress or egress through both sets of openings as directed by Architect. Locate actuators, key switches, and other controls as directed by Architect.
11. Provide units with vestibule inputs that allow sequencing operation of two units, and SPDT relay for interfacing with latching or locking devices.

2.16 PROTECTION PLATES

A. Manufacturers:

1. Scheduled Manufacturer: Ives.
2. Acceptable Manufacturers: Burns, Hiawatha.

B. Requirements:

1. Provide kick plates, mop plates, and armor plates minimum of 0.050 inch (1 mm) thick, beveled four edges as scheduled. Furnish with sheet metal or wood screws, finished to match plates.
2. Sizes of plates:

    a. Kick Plates: 8 inches (204 mm) high by 1-1/2 inches (38 mm) less width of door on single doors, 1 inch (25 mm) less width of door on pairs

2.17 OVERHEAD STOPS AND OVERHEAD STOP/HOLDERS

A. Manufacturers:

1. Scheduled Manufacturers: Glynn-Johnson.
2. Acceptable Manufacturers: Rixson, Sargent.

B. Requirements:

1. Provide heavy or medium duty and concealed or surface mounted overhead stop or holder for doors as specified. Provide medium duty surface mounted overhead stop for interior doors and at any door that swings more than 140 degrees before striking wall, open against equipment, casework, sidelights, and where conditions do not allow wall stop or floor stop presents tripping hazard.
2. Where overhead holders are specified provide friction type at doors without closer and positive type at doors with closer.

2.18 DOOR STOPS AND HOLDERS

A. Manufacturers:

1. Scheduled Manufacturer: Ives.
2. Acceptable Manufacturers: Burns, Rockwood.

B. Provide door stops at each door leaf:

1. Provide wall stops wherever possible. Provide convex type where mortise type locks are used and concave type where cylindrical type locks are used.
2. Where a wall stop cannot be used, provide universal floor stops for low or high rise options.
3. Where wall or floor stop cannot be used, provide overhead stop.

2.19 THRESHOLDS, SEALS, DOOR SWEEPS, AUTOMATIC DOOR BOTTOMS, AND GASKETING

A. Manufacturers:

1. Scheduled Manufacturer: Zero International.
2. Acceptable Manufacturers: National Guard, Pemko.

B. Requirements:

1. Provide thresholds, weather-stripping (including door sweeps, seals, and astragals) and gasketing systems (including smoke, sound, and light) as specified and per architectural details. Match finish of other items.

2. Smoke- and Draft-Control Door Assemblies: Where smoke- and draft-control door assemblies are required, provide door hardware that meets requirements of assemblies tested according to UL 1784 and installed in compliance with NFPA 105.
3. Size of thresholds:

a. Saddle Thresholds: 1/2 inch (13 mm) high by jamb width by door width

b. Bumper Seal Thresholds: 1/2 inch (13 mm) high by 5 inches (127 mm) wide by door width

4. Provide door sweeps, seals, astragals, and auto door bottoms only of type where resilient or flexible seal strip is easily replaceable and readily available.

2.20 SILENCERS

A. Manufacturers:

1. Scheduled Manufacturer: Ives.
2. Acceptable Manufacturers: Burns, Rockwood.

B. Requirements:

1. Provide "push-in" type silencers for hollow metal or wood frames.
2. Provide one silencer per 30 inches (762 mm) of height on each single frame, and two for each pair frame.
3. Omit where gasketing is specified.

2.21 MAGNETIC HOLDERS

A. Manufacturers:

1. Scheduled Manufacturer: LCN.
2. Acceptable Manufacturers: Rixson, Sargent.

B. Requirements:

1. Provide wall or floor mounted electromagnetic door release as specified with minimum of 25 pounds of holding force. Coordinate projection of holder and armature with other hardware and wall conditions to ensure that door sits parallel to wall when fully open. Connect magnetic holders on fire-rated doors into the fire control panel for fail-safe operation.

2.22 ROLLER CATCHES

A. Manufacturers:

1. Scheduled Manufacturer: Ives.
2. Acceptable Manufacturers: Engineered Products Company, Rockwood.

B. Requirements:

1. Provide catches with self-aligning magnets that can be surface mounted or mortised.
2. Provide catches in an aluminum case 1 inch wide x 3-1/8 inch long.

2.23 DOOR VIEWERS

A. Manufacturers:

1. Scheduled Manufacturer: Ives.
2. Acceptable Manufacturers: Burns, Rockwood.

B. Provide appropriate door viewer for door type and rating with minimum of 180-degree view area.

2.24 LATCH PROTECTORS

A. Manufacturers:

1. Scheduled Manufacturer: Ives.
2. Acceptable Manufacturers: Burns, Rockwood.

B. Provide stainless steel latch protectors of type required to function with specified lock.

2.25 COAT HOOKS

A. Manufacturers:

1. Scheduled Manufacturer: Ives.
2. Acceptable Manufacturers: Burns, Rockwood.

B. Provide coat hooks as specified.

2.26 FINISHES

A. Finish: BHMA 626/652 (US26D); except:

1. Hinges at Exterior Doors: BHMA 630 (US32D)
2. Push Plates, Pulls, and Push Bars: BHMA 630 (US32D)
3. Protection Plates: BHMA 630 (US32D)
4. Overhead Stops and Holders: BHMA 630 (US32D)
5. Door Closers: Powder Coat to Match
6. Wall Stops: BHMA 630 (US32D)
7. Latch Protectors: BHMA 630 (US32D)
8. Weatherstripping: Clear Anodized Aluminum
9. Thresholds: Mill Finish Aluminum

PART 3 - EXECUTION

3.01 EXAMINATION

A. Prior to installation of hardware, 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.

B. Field verify existing doors and frames receiving new hardware and existing conditions receiving new openings. Verify that new hardware is compatible with existing door and frame preparation and existing conditions.

C. Examine roughing-in for electrical power systems to verify actual locations of wiring connections before electrified door hardware installation.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. 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. Custom Steel Doors and Frames: HMMA 831.
3. Wood Doors: DHI WDHS.3, "Recommended Locations for Architectural Hardware for Wood Flush Doors."

B. Install each hardware item in compliance with manufacturer's instructions and recommendations, using only fasteners provided by manufacturer.

C. Do not install surface mounted items until finishes have been completed on substrate. Protect all installed hardware during painting.

D. Set units level, plumb and true to line and location. Adjust and reinforce attachment substrate as necessary for proper installation and operation.

E. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.

F. Install operating parts so they move freely and smoothly without binding, sticking, or excessive clearance.

G. Hinges: Install types and in quantities indicated in door hardware schedule but not fewer than quantity recommended by manufacturer for application indicated or one hinge for every 30 inches (750 mm) of door height, whichever is more stringent, unless other equivalent means of support for door, such as spring hinges or pivots, are provided.

H. Lock Cylinders: Install construction cores to secure building and areas during construction period.

1. Replace construction cores with permanent cores as indicated in keying section.

I. Wiring: Coordinate with Division 26, ELECTRICAL sections for:

1. Conduit, junction boxes and wire pulls.
2. Connections to and from power supplies to electrified hardware.
3. Connections to fire/smoke alarm system and smoke evacuation system.
4. Connection of wire to door position switches and wire runs to central room or area, as directed by Architect.
5. Testing and labeling wires with Architect's opening number.

J. Key Control System: Tag keys and place them on markers and hooks in key control system cabinet, as determined by final keying schedule.

K. Door Closers: Mount closers on room side of corridor doors, inside of exterior doors, and stair side of stairway doors from corridors. Mount closers so they are not visible in corridors, lobbies and other public spaces unless approved by Architect.

L. Closer/Holders: Mount closer/holders on room side of corridor doors, inside of exterior doors, and stair side of stairway doors.

M. Thresholds: Set thresholds in full bed of sealant complying with requirements specified in Division 07 Section "Joint Sealants."

N. 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 may impede traffic or present tripping hazard.

O. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.

P. Meeting Stile Gasketing: Fasten to meeting stiles, forming seal when doors are closed.

Q. Door Bottoms: Apply to bottom of door, forming seal with threshold when door is closed.

3.03 FIELD QUALITY CONTROL

A. Engage qualified manufacturer trained representative to perform inspections and to prepare inspection reports.

1. Representative will inspect door hardware and state in each report whether installed work complies with or deviates from requirements, including whether door hardware is properly installed and adjusted.

3.04 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. Spring Hinges: Adjust to achieve positive latching when door is allowed to close freely from an open position of 30 degrees.
2. Electric Strikes: Adjust horizontal and vertical alignment of keeper to properly engage lock bolt.
3. Door Closers: Adjust sweep period to comply with accessibility requirements and requirements of authorities having jurisdiction.

B. Occupancy Adjustment: Approximately three to six months after date of Substantial

Completion, Installer's Architectural Hardware Consultant must examine and readjust each item of door hardware, including adjusting operating forces, as necessary to ensure function of doors and door hardware.

3.05 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 door hardware is without damage or deterioration at time of Substantial Completion.

3.06 DOOR HARDWARE SCHEDULE

A. Hardware items are referenced in the following hardware. Refer to the above-specifications for special features, options, cylinders/keying, and other requirements.

Hardware Sets:

Hardware Group No. 01
Provide each OPENING with the following:

QTY	DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1		HARDWARE BY DOOR MANUFACTURER		

Hardware Group No. 02
Provide each OPENING with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	SET	HINGES	5BB1 4.5 X 4.5 [PER 08 71 00]	652	IVE
1	EA	ENTRY / OFFICE LOCK	W511BDC AVA	626	FAL
1	EA	SFIC EVEREST CORE	80-037 EV B	626	SCH
1	EA	SURFACE CLOSER	SC81A RW/PA	689	FAL
1	EA	KICK PLATE	8400 8" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS406/407CCV	630	IVE
1	EA	GASKETING	488FSBK PSA	BK	ZER

Hardware Group No. 02.1
Provide each OPENING with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	SET	HINGES	5BB1 4.5 X 4.5 [PER 08 71 00]	652	IVE
1	EA	ENTRY / OFFICE LOCK	W511BDC AVA	626	FAL
1	EA	SFIC EVEREST CORE	80-037 EV B	626	SCH
1	EA	OH STOP	450S	630	GLY
1	EA	SURFACE CLOSER	SC81A RW/PA	689	FAL
1	EA	KICK PLATE	8400 8" X 2" LDW B-CS	630	IVE
1	EA	GASKETING	488FSBK PSA	BK	ZER

Hardware Group No. 03

Provide each OPENING with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	SET	HINGES	5BB1 4.5 X 4.5 [PER 08 71 00]	652	IVE
1	EA	STOREROOM LOCK	W581BDC AVA	626	FAL
1	EA	SFIC EVEREST CORE	80-037 EV B	626	SCH
1	EA	OH STOP	450S	630	GLY
1	EA	SURFACE CLOSER	SC81A RW/PA	689	FAL
1	EA	KICK PLATE	8400 8" X 2" LDW B-CS	630	IVE
1	EA	GASKETING	488FSBK PSA	BK	ZER

Hardware Group No. 03.1

Provide each OPENING with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	SET	HINGES	5BB1 4.5 X 4.5 [PER 08 71 00]	652	IVE
1	EA	STOREROOM LOCK	W581BDC AVA	626	FAL
1	EA	SFIC EVEREST CORE	80-037 EV B	626	SCH
1	EA	SURFACE CLOSER	SC81A RW/PA	689	FAL
1	EA	KICK PLATE	8400 8" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS406/407CCV	630	IVE
1	EA	GASKETING	488FSBK PSA	BK	ZER

Hardware Group No. 04

Provide each OPENING with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	SET	HINGES	5BB1 4.5 X 4.5 [PER 08 71 00]	652	IVE
1	EA	CLASSROOM LOCK	W561BDC AVA	626	FAL
1	EA	SFIC EVEREST CORE	80-037 EV B	626	SCH
1	EA	SURFACE CLOSER	SC81A RW/PA	689	FAL
1	EA	KICK PLATE	8400 8" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS406/407CVX	630	IVE
1	EA	GASKETING	488FSBK PSA	BK	ZER

Hardware Group No. 04.1

Provide each OPENING with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	SET	HINGES	5BB1 4.5 X 4.5 [PER 08 71 00]	652	IVE
1	EA	CLASSROOM LOCK	W561BDC AVA	626	FAL
1	EA	SFIC EVEREST CORE	80-037 EV B	626	SCH
1	EA	SURFACE CLOSER	SC81A RW/PA	689	FAL
1	EA	KICK PLATE	8400 8" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS406/407CVX	630	IVE
1	EA	GASKETING	488FSBK PSA	BK	ZER
1	EA	CREDENTIAL OR FOB READER	BY ACCESS CONTROL PROVIDER	BLK	SCE

Hardware Group No. 05

Provide each OPENING with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
2	SET	HINGES	5BB1 4.5 X 4.5 [PER 08 71 00]	652	IVE
1	EA	CONST LATCHING BOLT	FB51T	630	IVE
1	EA	CLASSROOM LOCK	W561BDC AVA	626	FAL
1	EA	SFIC EVEREST CORE	80-037 EV B	626	SCH
2	EA	WALL STOP	WS406/407CVX	630	IVE
2	EA	SILENCER	SR64/SR65 AS REQ'D	GRY	IVE

Hardware Group No. 05.1

Provide each OPENING with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
2	SET	HINGES	5BB1 4.5 X 4.5 [PER 08 71 00]	652	IVE
1	EA	CONST LATCHING BOLT	FB51T	630	IVE
1	EA	CLASSROOM LOCK	W561BDC AVA	626	FAL
1	EA	SFIC EVEREST CORE	80-037 EV B	626	SCH
2	EA	OH STOP	450S	630	GLY
2	EA	SILENCER	SR64/SR65 AS REQ'D	GRY	IVE

Hardware Group No. 06

Provide each OPENING with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
2	SET	HINGES	5BB1 4.5 X 4.5 [PER 08 71 00]	652	IVE
1	SET	AUTO FLUSH BOLT	FB32	630	IVE
1	EA	CLASSROOM LOCK	W561BDC AVA	626	FAL
1	EA	SFIC EVEREST CORE	80-037 EV B	626	SCH
1	EA	COORDINATOR	COR X FL	628	IVE
2	EA	MOUNTING BRACKET	MB [AS REQ'D]	689	IVE
2	EA	SURFACE CLOSER	SC81A HDPA	689	FAL
2	EA	KICK PLATE	8400 8" X 1" LDW B-CS	630	IVE
2	EA	FIRE/LIFE WALL MAG	SEM7800 SERIES AS REQ'D	689	LCN
1	EA	GASKETING	488FSBK PSA	BK	ZER
1	EA	GASKETING	8217SBK PSA	BK	ZER

DESCRIPTION OF OPERATION;

UPON POWER LOSS OR FIRE ALARM SIGNAL DOORS TO RELEASE FROM MAGNETIC HOLDERS, CLOSE AND LATCH.

Hardware Group No. 07
Provide each OPENING with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
2	SET	HINGE	5BB1 4.5 X 4.5 NRP [PER 08 71 00]	630	IVE
1	EA	POWER TRANSFER	EPT10	689	VON
1	SET	AUTO FLUSH BOLT	FB31P/FB41P AS REQ'D	630	IVE
1	EA	DUST PROOF STRIKE	DP2	626	IVE
1	EA	STOREROOM LOCK	W581BDC AVA	626	FAL
1	EA	SFIC EVEREST CORE	80-037 EV B	626	SCH
1	EA	ELECTRIC STRIKE	6223 FSE	630	VON
1	EA	LOCK GUARD	LG14	630	IVE
1	EA	COORDINATOR	COR X FL	628	IVE
2	EA	MOUNTING BRACKET	MB [AS REQ'D]	689	IVE
2	EA	OH STOP	100S	630	GLY
1	EA	SURFACE CLOSER	SC71 HDPA	689	FAL
1	EA	AUTO OPERATOR	4642	689	LCN
2	EA	ACTUATOR	8310-853T	630	LCN
2	EA	KICK PLATE	8400 8" X 1" LDW B-CS	630	IVE
1	EA	RAIN DRIP	142AA	AA	ZER
1	EA	GASKETING	488FSBK PSA	BK	ZER
1	EA	GASKETING	8217SBK PSA	BK	ZER
2	EA	MEETING STILE	383AA	AA	ZER
2	EA	DOOR SWEEP	39A	A	ZER
1	EA	THRESHOLD	655A-223	A	ZER
1	EA	CREDENTIAL READER	BY ACCESS CONTROL PROVIDER	BLK	SCE
2	EA	DOOR CONTACT	BY ACCESS CONTROL PROVIDER	628	SCE
1	EA	MOTION SENSOR	BY ACCESS CONTROL PROVIDER	WHT	SCE
1	EA	POWER SUPPLY	BY ACCESS CONTROL PROVIDER	LGR	SCE

OPERATION: VALID CREDENTIAL RELEASES ELECTRIC STRIKE ALLOWING ENTRY AND TURNS ON EXTERIOR WALL ACTUATOR. INTERIOR ACTUATOR ALWAYS ACTIVE. FREE EGRESS AT ALL TIMES.

Hardware Group No. 07.1
Provide each OPENING with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	SET	HINGE	5BB1 4.5 X 4.5 NRP [PER 08 71 00]	630	IVE
1	EA	STOREROOM LOCK	W581BDC AVA	626	FAL
1	EA	SFIC EVEREST CORE	80-037 EV B	626	SCH
1	EA	ELECTRIC STRIKE	6211 FSE 12/16/24/28 VAC/VDC	630	VON
1	EA	LOCK GUARD	LG14	630	IVE
1	EA	SURFACE CLOSER	SC71 SS	689	FAL
1	EA	AUTO OPERATOR	4642	689	LCN
1	EA	WEATHER RING	8310-801	PLA	LCN
2	EA	ACTUATOR	8310-853T	630	LCN
1	EA	KICK PLATE	8400 8" X 2" LDW B-CS	630	IVE
1	EA	RAIN DRIP	142AA	AA	ZER
1	EA	GASKETING	488FSBK PSA	BK	ZER
1	EA	GASKETING	8217SBK PSA	BK	ZER
1	EA	MEETING STILE	383AA	AA	ZER
1	EA	DOOR SWEEP	39A	A	ZER
1	EA	THRESHOLD	655A-223	A	ZER
1	EA	CREDENTIAL OR FOB READER	BY ACCESS CONTROL PROVIDER	BLK	SCE
1	EA	CREDENTIAL OR FOB READER	BY ACCESS CONTROL PROVIDER	BLK	SCE
1	EA	DOOR CONTACT	BY ACCESS CONTROL PROVIDER	628	SCE
1	EA	MOTION SENSOR	BY ACCESS CONTROL PROVIDER	WHT	SCE
1	EA	MOTION SENSOR	BY ACCESS CONTROL PROVIDER	WHT	SCE
1	EA	POWER SUPPLY	BY ACCESS CONTROL PROVIDER	LGR	SCE
1	EA	POWER SUPPLY	BY ACCESS CONTROL PROVIDER	LGR	SCE

OPERATION: VALID CREDENTIAL RELEASES ELECTRIC STRIKE ALLOWING ENTRY AND TURNS ON EXTERIOR WALL ACTUATOR. INTERIOR ACTUATOR ALWAYS ACTIVE. FREE EGRESS AT ALL TIMES.

Hardware Group No. 08
Provide each OPENING with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	SET	HINGES	5BB1 4.5 X 4.5 [PER 08 71 00]	652	IVE
1	EA	PASSAGE SET	W101S AVA	626	FAL
1	EA	OH STOP	450S	630	GLY
3	EA	SILENCER	SR64/SR65 AS REQ'D	GRY	IVE

Hardware Group No. 09
Provide each OPENING with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	SET	HINGES	5BB1 4.5 X 4.5 [PER 08 71 00]	652	IVE
1	EA	CLASSROOM LOCK	W561BDC AVA	626	FAL
1	EA	SFIC EVEREST CORE	80-037 EV B	626	SCH
1	EA	OH STOP	450S	630	GLY
3	EA	SILENCER	SR64/SR65 AS REQ'D	GRY	IVE

Hardware Group No. 10

Provide each OPENING with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	SET	HINGE	5BB1 4.5 X 4.5 NRP [PER 08 71 00]	630	IVE
1	EA	FIRE EXIT HARDWARE	F-25-V-EO-LBR	626	FAL
1	EA	SFIC EVEREST CORE	80-037 EV B	626	SCH
1	EA	SURFACE CLOSER	SC71 SS	689	FAL
1	EA	KICK PLATE	8400 8" X 2" LDW B-CS	630	IVE
1	EA	RAIN DRIP	142AA	AA	ZER
1	SET	GASKETING	429AA-S	AA	ZER
1	EA	DOOR SWEEP	39A	A	ZER
1	EA	THRESHOLD	655A-223	A	ZER
1	EA	DOOR CONTACT	BY ACCESS CONTROL PROVIDER	628	SCE

DESCRIPTION OF OPERATION: EXIT ONLY DOOR TO REMAIN CLOSED AND LATCHED. NO LEVER ON EXTERIOR SIDE OF DOOR.

Hardware Group No. 11
Provide each OPENING with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
2	SET	HINGE	5BB1 4.5 X 4.5 NRP [PER 08 71 00]	630	IVE
1	SET	AUTO FLUSH BOLT	FB31P/FB41P AS REQ'D	630	IVE
1	EA	DUST PROOF STRIKE	DP2	626	IVE
1	EA	STOREROOM LOCK	W581BDC AVA	626	FAL
1	EA	SFIC EVEREST CORE	80-037 EV B	626	SCH
1	EA	LOCK GUARD	LG10	630	IVE
1	EA	COORDINATOR	COR X FL	628	IVE
2	EA	MOUNTING BRACKET	MB [AS REQ'D]	689	IVE
2	EA	SURFACE CLOSER	SC71 SS	689	FAL
2	EA	KICK PLATE	8400 8" X 1" LDW B-CS	630	IVE
1	EA	RAIN DRIP	142AA	AA	ZER
1	EA	GASKETING	488FSBK PSA	BK	ZER
2	EA	MEETING STILE	383AA	AA	ZER
2	EA	DOOR SWEEP	39A	A	ZER
1	EA	THRESHOLD	655A-223	A	ZER
2	EA	DOOR CONTACT	BY ACCESS CONTROL PROVIDER	628	SCE

Hardware Group No. 12
Provide each OPENING with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	SET	HINGES	5BB1 4.5 X 4.5 [PER 08 71 00]	652	IVE
1	EA	PRIVACY LOCK	W301S AVA	626	FAL
1	EA	SURFACE CLOSER	SC81A RW/PA	689	FAL
1	EA	MOP PLATE	8400 4" X 1" LDW B-CS	630	IVE
1	EA	KICK PLATE	8400 8" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS406/407CCV	630	IVE
1	EA	GASKETING	488FSBK PSA	BK	ZER

Hardware Group No. 13
Provide each OPENING with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	SET	HINGES	5BB1 4.5 X 4.5 [PER 08 71 00]	652	IVE
1	EA	PASSAGE SET	W101S AVA	626	FAL
1	EA	SURFACE CLOSER	SC81A RW/PA	689	FAL
1	EA	KICK PLATE	8400 8" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS406/407CVX	630	IVE
1	EA	GASKETING	488FSBK PSA	BK	ZER

Hardware Group No. 13.1
Provide each OPENING with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	SET	HINGES	5BB1 4.5 X 4.5 [PER 08 71 00]	652	IVE
1	EA	PASSAGE SET	W101S AVA	626	FAL
1	EA	SURFACE CLOSER	SC81A RW/PA	689	FAL
1	EA	KICK PLATE	8400 8" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS406/407CVX	630	IVE
1	EA	GASKETING	488FSBK PSA	BK	ZER
1	EA	CREDENTIAL OR FOB READER	BY ACCESS CONTROL PROVIDER	BLK	SCE

Hardware Group No. 14
Provide each OPENING with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
6	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
2	EA	FIRE EXIT HARDWARE	F-25-V-EO-LBR	626	FAL
2	EA	SURFACE CLOSER	SC71 HDPA	689	FAL
2	EA	KICK PLATE	8400 8" X 1" LDW B-CS	630	IVE
2	EA	FIRE/LIFE WALL MAG	SEM7800 SERIES AS REQ'D	689	LCN
2	SET	MEETING STILE	328AA-S	AA	ZER
1	EA	GASKETING	488SBK PSA	BK	ZER

DESCRIPTION OF OPERATION;
UPON POWER LOSS OR FIRE ALARM SIGNAL DOORS TO RELEASE FROM MAGNETIC HOLDERS, CLOSE AND LATCH.

Hardware Group No. 15
Provide each OPENING with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	SET	HINGES	5BB1 4.5 X 4.5 [PER 08 71 00]	652	IVE
1	EA	STOREROOM LOCK	W581BDC AVA	626	FAL
1	EA	SFIC EVEREST CORE	80-037 EV B	626	SCH
1	EA	SURFACE CLOSER	SC81A RW/PA	689	FAL
1	EA	KICK PLATE	8400 8" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS406/407CCV	630	IVE
1	EA	GASKETING	488FSBK PSA	BK	ZER

Hardware Group No. 16
Provide each OPENING with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
2	EA	SPRING HINGE	3SP1 4 X 4	652	IVE
1	EA	HINGE	5BB1 4 X 4	652	IVE
1	EA	ENTRANCE LOCK	CS210-B60J JUP JAZ PLY	626	SCH
1	EA	FSIC CORE	91-161 EV B	626	SCH
1	EA	DOOR STOP	060 OR 70 AS REQ'D	F15	IVE
1	EA	GASKETING	488FSBK PSA	BK	ZER
1	EA	DOOR SWEEP	253A	A	ZER
1	EA	THRESHOLD	1682A-223	A	ZER
1	EA	VIEWER	U700 [PROVIDE 2 @ ACCESSIBLE UNITS]	626	IVE

Hardware Group No. 17
Provide each OPENING with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	1011 3.5 X 3.5	646	IVE
1	EA	PRIVACY LOCK	F40 JAZ	626	SCH
1	EA	DOOR STOP	060 OR 70 AS REQ'D	F15	IVE
1	EA	COAT AND HAT HOOK	582 [PROVIDE ONLY @ BATHROOM]	619	IVE

Hardware Group No. 18
Provide each OPENING with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	1011 3.5 X 3.5	646	IVE
1	EA	PASSAGE SET	F10 JAZ	626	SCH
1	EA	DOOR STOP	060 OR 70 AS REQ'D	F15	IVE

NOTE: SEE DOOR SCHEDULE FOR OPENINGS THAT DO NOT REQUIRE LEVER.

Hardware Group No. 19
Provide each OPENING with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
6	EA	HINGE	1011 3.5 X 3.5	646	IVE
2	EA	BALL CATCH	349	626	IVE
2	EA	SINGLE DUMMY TRIM	F170 JAZ	626	SCH
2	EA	DOOR STOP	060 OR 70 AS REQ'D	F15	IVE

END OF SECTION

SECTION 08 80 00

GLAZING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Insulating glass units.

B. Glazing units.

C. Glazing compounds and accessories.

1.02 RELATED REQUIREMENTS

A. Section 08 1113 - Hollow Metal Doors and Frames: Glazed lites in doors and borrowed lites.

B. Section 08 1433 - Stile and Rail Wood Doors: Glazed lites in doors.

C. Section 08 4126 - All-Glass Entrances and Storefronts: Glazing furnished as part of entrance assembly.

D. Section 08 4229 - Automatic Entrances: Glazing furnished as part of door assembly.

E. Section 08 4313 - Aluminum-Framed Storefronts: Glazing furnished as part of storefront assembly.

F. Section 08 5113 - Aluminum Windows: Glazing furnished by window manufacturer.

G. Section 08 5123 - Steel Windows: Glazing furnished by window manufacturer.

H. Section 08 5200 - Wood Windows: Glazing furnished by window manufacturer.

I. Section 08 5313 - Vinyl Windows: Glazing furnished by window manufacturer.

1.03 REFERENCE STANDARDS

A. ASTM C864 - Standard Specification for Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers 2005 (Reapproved 2015).

B. ASTM C1193 - Standard Guide for Use of Joint Sealants 2016.

C. GANA (SM) - GANA Sealant Manual 2008.

D. ICC (IBC) - International Building Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene a preinstallation meeting one week before starting work of this section; require attendance by each of the affected installers.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data on Insulating Glass Unit, Glazing Unit, Plastic Sheet Glazing

Unit, and Plastic Film Glazing Types: Provide structural, physical and environmental characteristics, size limitations, special handling and installation requirements.

C. Product Data on Glazing Compounds and Accessories: Provide chemical, functional, and environmental characteristics, limitations, special application requirements, and identify available colors.

D. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.06 QUALITY ASSURANCE

A. Perform Work in accordance with for glazing installation methods. Maintain one copy on site.

B. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years documented experience.

1.07 FIELD CONDITIONS

A. Do not install glazing when ambient temperature is less than 40 degrees F.

B. Maintain minimum ambient temperature before, during and 24 hours after installation of glazing compounds.

1.08 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design glass, including comprehensive engineering analysis according to ASTM E 1300 and ICC's 2009 International Building Code by a qualified professional engineer, using the following design criteria:
   1. Design Wind Pressures: As indicated on structural Drawings.

1.09 DESIGN SNOW LOADS: [AS INDICATED ON DRAWINGS].

A. If referencing ASTM E 1300, retain applicable subparagraphs from first three below, which are based on requirements in the 2006 IBC.
   1. Vertical Glazing: For glass surfaces sloped 15 degrees or less from vertical, design glass to resist design wind pressure based on glass type factors for short- duration load.
   2. Differential Shading: Design glass to resist thermal stresses induced by differential shading within individual glass lites.

B. Safety Glazing: Provide safety glazing in the following applications.
   1. Glazing in swinging doors except jalousies.
   2. Glazing in fixed and sliding panels of sliding door assemblies and panels in sliding and bifold closet door assemblies.
   3. Glazing in storm doors.
   4. Glazing in unframed swinging doors.
   5. Glazing in doors and enclosures for hot tubs, whirlpools, saunas, steam rooms, bathtubs and showers. Glazing in any portion of a building wall enclosing these compartments where the bottom exposed edge of the glazing is less than 60 inches (1524 mm)above a standing surface.
   6. Glazing in an individual fixed or operable panel adjacent to a door where the nearest exposed edge of the glazing is within a 24-inch (610 mm) arc of either vertical edge of the door in a closed position and where the bottom exposed edge of the glazing is less than 60 inches (1524 mm) above the walking surface.

7. Glazing in an individual fixed or operable panel, other than in those locations described in preceding Items 5 and 6, which meets all of the following conditions:
   a. Exposed area of an individual pane greater than 9 square feet (0.84 m2);
   b. Exposed bottom edge less than 18 inches (457 mm) above the floor;
   c. Exposed top edge greater than 36 inches (914 mm) above the floor; and
   d. One or more walking surface(s) within 36 inches (914 mm) horizontally of the plane of the glazing.
8. Glazing in guards and railings, including structural baluster panels and nonstructural in-fill panels, regardless of area or height above a walking surface.
9. Glazing adjacent to stairways, landings and ramps within 36 inches (914 mm) horizontally of a walking surface; when the exposed surface of the glass is less than 60 inches (1524 mm) above the plane of the adjacent walking surface.
10. Glazing adjacent to stairways within 60 inches (1524 mm) horizontally of the bottom tread of a stairway in any direction when the exposed surface of the glass is less than 60 inches (1524 mm) above the nose of the tread.

1.10 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Insulating Glass Units: Provide a five (5) year manufacturer warranty to include coverage for seal failure, interpane dusting or misting, including providing products to replace failed units.

C. Laminated Glass: Provide a five (5) year manufacturer warranty to include coverage for delamination, including providing products to replace failed units.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Glass Fabricators:
   1. JE Berkowitz, LP: www.jeberkowitz.com.
   2. Trulite Glass & Aluminum Solutions, LLC: www.trulite.com/#sle.
   3. Viracon, Inc: www.viracon.com/#sle.

B. Float Glass Manufacturers:
   1. AGC Glass North America, Inc; [___]: www.agcglass.com/#sle.
   2. Cardinal Glass Industries; [___]: www.cardinalcorp.com/#sle.
   3. Guardian Glass, LLC; [___]: www.guardianglass.com/#sle.
   4. Pilkington North America Inc; [___]: www.pilkington.com/na/#sle.
   5. Vitro Architectural Glass (formerly PPG Glass); [_____] : www.vitroglazings.com/#sle.
   6. Substitutions: Refer to Section 01 6000 - Product Requirements.

C. Fire-Resistance-Rated Glass: Provide products as required to achieve indicated fire- rating period.
   1. SAFTIFIRST, a division of O'Keeffe's Inc; SuperLite II-XL:

www.safti.com/#sle.
2. Technical Glass Products; Pilkington Pyrostop: www.fireglass.com/#sle.
3. Vetrotech North America; Contraflam: www.vetrotechusa.com/#sle.
4. Substitutions: Refer to Section 01 6000 - Product Requirements.

D. Fire-Protection-Rated Glass: Provide products as required to achieve indicated fire- rating period.
1. SAFTIFIRST, a division of O'Keeffe's Inc; SuperLite I-XL: www.safti.com/#sle.
2. SCHOTT North America Inc; PYRAN Platinum 20: www.us.schott.com/#sle.
3. Technical Glass Products; [___]: www.fireglass.com/#sle.
4. Vetrotech North America; Contraflam 45: www.vetrotechusa.com/#sle.
5. Substitutions: Refer to Section 01 6000 - Product Requirements.

2.02 ACCESSORIES

A. Setting Blocks: Silicone, with 80 to 90 Shore A durometer hardness; ASTM C864 Option II. Length of 0.1 inch for each square foot of glazing or minimum 4 inch by width of glazing rabbet space minus 1/16 inch by height to suit glazing method and pane weight and area.

B. Spacer Shims: Neoprene, 50 to 60 Shore A durometer hardness; ASTM C864 Option
II. Minimum 3 inch long by one half the height of the glazing stop by thickness to suit application, self adhesive on one face.

C. Glazing Tape, Back Bedding Mastic Type: Preformed, butyl-based, 100 percent solids compound with integral resilient spacer rod applicable to application indicated; 5 to 30 cured Shore A durometer hardness; coiled on release paper; black color.
1. Width: As required for application.
2. Thickness: As required for application.
3. Spacer Rod Diameter: As required for application.
4. Manufacturers:
a. Pecora Corporation: www.pecora.com.
b. Tremco Global Sealants: www.tremcosealants.com.
c. Substitutions: Refer to Section 01 6000 - Product Requirements.

D. Glazing Splines: Resilient silicone extruded shape to suit glazing channel retaining slot; ASTM C864 Option II; color black.

E. Glazing Clips: Manufacturer's standard type.

F. Smoke Removal Window/Glazing Unit Markings: Adhesive backed markings affixed to manually operable or fixed windows of high-rise buildings to identify units intended for post-fire smoke removal in compliance with ICC (IBC) and local building officials.

2.03 SOURCE QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for additional requirements.

PART 3 EXECUTION

3.01 VERIFICATION OF CONDITIONS

A. Verify that openings for glazing are correctly sized and within tolerances, including those for size, squareness, and offsets at corners.

B. Verify that surfaces of glazing channels or recesses are clean, free of obstructions that may impede moisture movement, weeps are clear, and support framing is ready to receive glazing system.

3.02 PREPARATION

A. Clean contact surfaces with appropriate solvent and wipe dry within maximum of 24 hours before glazing. Remove coatings that are not tightly bonded to substrates.

B. Seal porous glazing channels or recesses with substrate compatible primer or sealer.

C. Prime surfaces scheduled to receive sealant where required for proper sealant adhesion.

3.03 INSTALLATION, GENERAL

A. Install glazing sealants in accordance with ASTM C1193, GANA (SM), and manufacturer's instructions.

3.04 FIELD QUALITY CONTROL

A. Glass and Glazing product manufacturers to provide field surveillance of the installation of their products.

B. Monitor and report installation procedures and unacceptable conditions.

3.05 CLEANING

A. Remove excess glazing materials from finish surfaces immediately after application using solvents or cleaners recommended by manufacturers.

B. Remove non-permanent labels immediately after glazing installation is complete.

C. Clean glass and adjacent surfaces after sealants are fully cured.

D. Clean glass on both exposed surfaces not more than 4 days prior to Date of Substantial Completion in accordance with glass manufacturer's written recommendations.

3.06 PROTECTION

A. After installation, mark pane with an 'X' by using removable plastic tape or paste; do not mark heat absorbing or reflective glass units.

B. Remove and replace glass that is damaged during construction period prior to Date of Substantial Completion.

END OF SECTION

SECTION 08 83 00

MIRRORS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Glass mirrors.
   1. Annealed float glass.

1.02 REFERENCE STANDARDS

A. ASTM C1036 - Standard Specification for Flat Glass 2016.

B. ASTM C1193 - Standard Guide for Use of Joint Sealants 2016.

C. ASTM C1503 - Standard Specification for Silvered Flat Glass Mirror 2018.

D. GANA (GM) - GANA Glazing Manual 2008.

E. GANA (SM) - GANA Sealant Manual 2008.

F. GANA (TIPS) - Mirrors: Handle with Extreme Care (Tips for the Professional on the Care and Handling of Mirrors) 2011.

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data on Mirror Types: Submit structural, physical and environmental characteristics, size limitations, special handling and installation requirements.

1.04 QUALITY ASSURANCE

A. Perform Work in accordance with GANA (GM) and GANA (SM) for glazing installation methods.

1.05 FIELD CONDITIONS

A. Do not install mirrors when ambient temperature is less than 50 degrees F.

B. Maintain minimum ambient temperature before, during and 24 hours after installation of glazing compounds.

1.06 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Provide five year manufacturer warranty for reflective coating on mirrors and replacement of same.

PART 2 PRODUCTS

2.01 MATERIALS

A. Mirror Design Criteria: Select materials and/or provide supports as required to limit mirror material deflection to 1/200, or to the flexure limit of glass, with full recovery of glazing materials, whichever is less.

B. Mirror Glass: Clear, annealed float glass; ASTM C1036, with copper and silver coatings, and protective overcoating.

1. Size: As noted on drawings.

2.02 ACCESSORIES

A. Setting Blocks: Neoprene, 80 to 90 Shore A durometer hardness.

B. Spacer Shims: Neoprene, 50 to 60 Shore A durometer hardness.

C. Glazing Tape: Preformed butyl compound; 10 to 15 Shore A durometer hardness; on release paper.

D. Glazing Clips: Manufacturer's standard type.

E. Mirror Attachment Accessories: Stainless steel clips.

F. Mirror Adhesive: Silicone pre-polymer based, chemically compatible with mirror coating and wall substrate.

G. Channel Frame where indicated: One piece, channel frame, stainless steel, Type 430, satin finish, 1/2 inch by 1/2 inch by 3/8 inch deep with 90 degree mitered corners.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that openings for mirrored glazing are correctly sized and within tolerance.

B. Verify that surfaces of mirror frames or recesses are clean, free of obstructions, and ready for installation of mirrors.

3.02 PREPARATION

A. Clean contact surfaces with solvent and wipe dry.

B. Seal porous mirror frames or recesses with substrate compatible primer or sealer. Prime surfaces scheduled to receive sealant.

C. Prepare installation in accordance with ASTM C1193 for solvent release sealants, and install sealant in accordance with manufacturer's instructions.

3.03 INSTALLATION

A. Install mirrors in accordance with GANA (TIPS) and manufacturers recommendations.

B. Set mirrors plumb and level, and free of optical distortion.

C. Set mirrors with edge clearance free of surrounding construction including countertops or backsplashes.

3.04 CLEANING

A. Remove wet glazing materials from finish surfaces.

B. Remove labels after work is complete.

C. Clean mirrors and adjacent surfaces.

3.05 PROTECTION

END OF SECTION

SECTION 09 21 16

GYPSUM BOARD SYSTEMS

PART 1 GENERAL

1.01 SCOPE

A. Provide gypsum board systems consisting of wall board and framing as indicated and specified. Work includes:

1. Gypsum board on wood framing.
2. Fire-rated gypsum board construction where indicated.
3. Edge trim, corner beads, control joints, accent reveals, fasteners, joint treatment materials and other accessories required for a complete installation.
4. Includes installation of acoustical insulation specified in Section 07 21 00.
5. Installation of metal access doors, including those provided by Plumbing and HVAC Contractors. See Section 08 31 13 and Divisions 22 and 23.

1.02 RELATED SECTIONS

A. Sustainable Design Requirements: Section 01 81 13.

B. Tile Backer Board: Section 09 30 00.

C. Cold-Formed Metal Framing: Section 05 40 00.

D. Acoustical Insulation: Section 07 21 00.

E. Sealant: Section 07 92 00.

F. Firestopping: Section 07 84 00.

G. Wood Blocking: Section 06 10 50.

H. Wood framing: Section 06 10 00.

1.03 QUALITY ASSURANCE

A. Gypsum Board Systems: Comply with ASTM C840 "Application and Finishing of Gypsum Board", and as specified.

B. Reference Standards: Wherever the following abbreviations are used herein they shall refer to the corresponding standard:

1. ASTM: American Society for Testing and Materials.

2. GA: Gypsum Association.

C. Fire-Rated Construction: Comply with fire resistance ratings indicated on drawings and as required by governing authorities and codes. Provide materials, accessories and application procedures that have been listed by Underwriters Laboratories or tested in accordance with ASTM E119 for the type of construction shown.

D. 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.

E. Guarantee: Submit written guarantee stating that cracks, delaminations or other imperfections in the drywall work which may develop within a period of 2 years from date of acceptance will be repaired at no cost to the Owner.

F. Job Mock-Up: Prior to start of finishing operations a job standard mock-up will be prepared. A unit room will be completely finished, including joint and screw taping and spackling, sanding, surface preparation and painting. Repair or redo mock-up until accepted by Architect. Job mock-up must be acceptable to Architect before beginning gypsum board finishing operations. Retain and maintain mock-up throughout remainder of project as a minimum workmanship standard. Gypsum board finishing quality must meet or exceed the quality of job mock-up. See Section 09 91 00 for mock-up painting.

G. Pre-Installation Conference: Conduct a pre-installation conference at Project site to review manufacturer's recommendations and referenced requirements for locating control joints in gypsum board walls and ceilings a minimum of one (1) week prior to beginning this portion of the Work. Have manufacturer's representative, contractor's representative and Architect present at this meeting. Conduct this conference to comply with requirements of Section 01 31 19, Project Meetings. See paragraph 3.08A for additional pre-installation conference requirements.

1.04 SUBMITTALS

A. Submit manufacturer's product data and installation instructions for each gypsum board system component.

B. Sustainable Design Documentation Submittals: Comply with Section 01 81 13.

1. VOC Limits: Include documentation verifying product Low Emitting Material Building Product Disclosures and Optimization.
2. All products to be compliant with CA Section 01350

C. Submit manufacturer's certification that fire-rated assemblies proposed meet project requirements, including evidence of approved test reports acceptable to governing building code enforcing authorities, that assemblies when installed with

proposed materials, will meet or exceed fire ratings required.

1.05 DELIVERY, STORAGE AND HANDLING

A. Deliver materials in manufacturer's original, unopened labeled containers.

B. Store, protect and handle materials in accordance with manufacturer's recommendations to prevent damage, soiling and deterioration. Protect cold-formed metal framing from corrosion, deformation and other damage during delivery, storage and handing per requirements of AISI's "Code of Standard Practice".

C. Protect adjoining surfaces against damage and soiling.

1.06 JOB CONDITIONS

A. Coordinate installation sequencing with work of other trades.

1. Verify completion of other work, including that of other trades, which will be concealed by gypsum drywall construction before installation of wallboard.

1.07 FIELD CONDITIONS

A. Environmental Limitations: Comply with ASTM C840 requirements or gypsum board manufacturer's written recommendations, whichever are more stringent.

PART 2 PRODUCTS

2.01 MANUFACTURER

A. Gypsum Board: U.S. GYPSUM CO.; CERTAINTEED CORP.; GEORGIA-PACIFIC CORP.; NATIONAL GYPSUM COMPANY; CONTINENTAL BUILDING PRODUCTS.

B. Others as listed for specific products.

2.02 METAL FURRING

A. Material

1. Steel Sheet Components: Comply with ASTM C645 requirements for metal, unless otherwise indicated.
2. Protective Coating: Coating with equivalent corrosion resistance of ASTM A653, G40, hot-dip galvanized, unless otherwise indicated.

B. Rigid Furring Channels: Hat-shaped; minimum 0.022 inch uncoated metal thickness; 7/8" deep, unless otherwise indicated.

C. Resilient Furring Channels: Minimum 0.0188” uncoated metal thickness; ½” deep; asymmetrical or hat-shaped members designed to reduce sound transmission.

2.05 GYPSUM BOARD

A. General: Comply with ASTM C1396.

1. Recycled Content of gypsum board: Synthetic drywall must be at least 95% recycled content; non-synthetic drywall it must be at least 10% post-consumer recycled content.

B. Paperless Gypsum Board (PGB) or equivalent must be used in the following areas.

1. Shower walls where the PGB will not have an exposed finish except 6 inches beyond shower and tub jambs (floor to top of tub surround or 6 inches above shower nipple and this may be cased with water and rot-resistant trim)
2. Behind toilets, the space between a tub/shower enclosure and to the top of toilet tanks.

C. Fire Rated Gypsum Wallboard: Type “C” or "X" (special fire retardant) to meet fire ratings for construction shown. Tapered edges. Thickness 5/8" unless otherwise indicated. Use at all locations indicated as meeting a specific fire resistance rating.

1. Provide 5/8”, Type X board at all locations not indicated to receive a specific type board.

D. Moisture and Mold Resistant Gypsum Wallboard:

1. ASTM C1278.
2. Type X.
3. Edges: Tapered.
4. Thickness: 5/8 inch.
5. Acceptable Products: Basis of design is USG Fiberock Brand Aqua-Tough AR.
6. Resistance to Mold Growth: ASTM D3273, “Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber,” the panel score was 10.
7. Use Moisture and Mold Resistant Gypsum Wallboard in the following locations except where PGB is required:
    a. On all vertical and horizontal surfaces that are within four feet of any water sources where the drywall can be splashed, including but not limited to kitchen sink, bath ceilings & walls, laundry rooms, utility / mech closets, etc.
    b. On ceilings where bathroom or toilet rooms are located above.
8. Maintain ratings where wall is required to be rated. When used on ceilings must be rated for the span.

E. Tile Backer Board: See Section 09 30 00.

2.06 ACCESSORIES

A. Fasteners: Drywall screws and metal framing screws per manufacturer's instructions and recommendations for type and size, based on construction and conditions involved.

1. Steel Drill Screws: ASTM C1002.
2. Use screws complying with ASTM C 954 for fastening panels to steel members from 0.033 to 0.112 inch thick specified in Section 05 40 00.

B. Trim: ASTM C1047.

1. Manufacturers
   a. Metal: BEADEX MANUFACTURING; CLARK DIETRICH BUILDING SYSTEMS; listed gypsum board manufacturers
   b. Vinyl: VINYL TECH; VINYL CORP.; TRIM TEX
2. Corner Beads - Outside, Square Corners: 1-1/4 inch x 1-1/4 inch heavy gauge galvanized steel or vinyl, perforated.
3. Corner Beads - Outside, Non-square Corners: BEADEX B-1 Splay Flexible Corner or equal. Concealed metal; two galvanized continuous strips laminated with paper trim; for application without mechanical fasteners.
4. Curved Edge Cornerbead: Notched or flexible edge.
5. Exposed Edges (Casing Beads): L-bead or LC-bead; exposed long flange receives joint compound. Size to suit wallboard. J-shaped bead that does not receive joint compound is not permitted.
6. Expansion (Control) Joints: Tape protected 1/4" wide x nominal 7/16" deep control slot.

C. Joint Treatment Materials: ASTM C475.

1. Joint Tape. Width to adequately cover joint.
   a. Interior Gypsum Board: Paper.
   b. Exterior Gypsum Soffit Board: Paper.
   c. Glass-Mat Gypsum Sheathing Board: 10-by-10 glass mesh.
2. Joint Compound for Interior Gypsum Wallboard: For each coat use formulation that is compatible with other compounds applied on previous or for successive coats.
   a. Prefilling: At open joints and damaged surface areas, use setting-type taping compound.
   b. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use setting-type taping compound.
      1) Use setting-type compound for installing paper-faced metal trim accessories.
   c. Fill Coat: For second coat, use setting-type, sandable topping compound.
   d. Finish Coat: For third coat, use setting-type, sandable topping compound.

e. Skim Coat: For final coat of Level 5 finish, use setting-type, sandable topping compound.

3. Joint Compound for Tile Backing Panels:
   a. Water-Resistant Gypsum Backing Board: Use setting-type taping compound and setting-type, sandable topping compound.
   b. Cementitious Backer Units: Section 09 30 00.

D. Additional Item: All additional accessories to complete work including nails and anchors to secure frames to walls and floors.

E. Acoustic Materials

1. Insulation: See Section 07 21 00.
2. Sealant: Nonsag, paintable, nonstaining latex sealant complying with ASTM C834. Product effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E90.
   a. Manufacturers
      1) USG Acoustical Sealant
      2) TREMCO Acoustical Sealant
      3) PECORA BA-98
   b. Acoustical joint sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
3. Neoprene impregnated sealant tape.
4. Head of Wall Insulation: Pre-manufactured, high-density mineral fiber acoustical insulation shaped to fit the trapezoidal flutes, typical of metal decking and complying with ASTM E119 as safing insulation.

PART 3 EXECUTION

3.01 PREPARATION

A. Provide adequate lighting and ventilation during installation and joint finishing treatment.

B. Coordination with Sprayed Fire-Resistive Materials

1. Before sprayed fire-resistive materials are applied, attach offset anchor plates or ceiling runners (tracks) to surfaces indicated to receive sprayed fire-resistive materials. Where offset anchor plates are required, provide continuous plates fastened to building structure not more than 24 inches o.c.
2. After sprayed fire-resistive materials are applied, remove them only to extent necessary for installation of non-load-bearing steel framing. Do not reduce thickness of fire-resistive materials below that required for fire-resistance ratings indicated. Protect adjacent fire-resistive materials from damage.

3.02 INSPECTION

A. Examine substrates and installation conditions. Do not proceed with gypsum wallboard work until unsatisfactory conditions have been corrected.

1. Protrusions of framing, twisted framing members, or unaligned members must be repaired before installation of wallboard is started.

B. Installation constitutes acceptance of existing conditions and responsibility for satisfactory performance.

3.03 FRAMING INSTALLATION

A. See Section 06 10 00.

B. Install all framing plumb and square with spacing as indicated.

C. Provide supplementary framing, blocking, and bracing at terminations in gypsum board assemblies to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction. Comply with details indicated and with recommendations of gypsum board manufacturer or, if none available, with United States Gypsum Company's "Gypsum Construction Handbook".

D. Provide a minimum of two (2) screws per connection.

3.04 FURRING INSTALLATION

A. Wall Application

1. Attach to masonry with expansion anchors or at mortar joints with concrete nails or expansion anchors.
2. Spacing shall be 16 in. o.c., unless otherwise indicated.
3. Run vertically or horizontally for maximum efficiency.

3.05 GYPSUM BOARD INSTALLATION

A. Gypsum Board Systems: Comply with ASTM C840.

B. General

1. Pre-installation Conference: Before start of gypsum board installation, meet at the project site with the Architect and installers of related work, including work requiring openings, chases, frames, access panels, support, similar integrated requirements and mechanical and electrical trades. Review potential interferences and conflicts and coordinate layout and sequencing requirements for proper installation and integration of the work.
   a. Do not proceed with gypsum board installation until blocking,

framing, bracing and other supports for subsequently applied work have been installed, reviewed and accepted by the Architect.

b. Do not install gypsum board until work concealed by gypsum board has been installed.

C. Application

1. Install gypsum board face side out. Do not install imperfect, damaged or damp boards.
2. Butt boards together for a light contact at edges and ends with not more than 1/16" open space between boards. Do not force into place.
3. Locate either edges or end joints over supports. Position boards so that both tapered edge joints abut. Do not place tapered edges against cut edges or ends. Stagger vertical joints over different studs on opposite sides of partitions.
4. Attach gypsum board to framing and blocking as required for additional support at openings and cutouts.
5. Floating Construction: Install gypsum board with "floating" internal corner construction, unless isolation of the intersecting board is indicated.
6. In addition to compliance with the standards, comply with specific requirements indicated for each type of arrangement of gypsum wallboard system shown. Space fasteners in accordance with manufacturer's recommendations and complying with referenced standards.
   a. Walls and Partitions: Apply sheets horizontally or vertically. Provide maximum sheet lengths to minimize end joints with edges or ends over supports. In two layer applications, stagger joints of second layer from joints of first layer.
   b. Cut and install panels to eliminate vertical joints in corners of door frames to ceiling.
   c. Make cutouts to fit within wall plate, register and grille flanged. All cutouts made by knife or saw.
   d. Make angles and corners clean, true, plumb and square; walls plumb, flat and straight and ceilings flat and level.
   e. Ceilings: Apply gypsum board on ceilings, before application on walls and partitions. Install in direction and manner to minimize end joints. Stagger end joints over supports. In two layer applications, stagger joints of second layer from joints of first layer.
7. Provide drywall metal corner clips per sustainable design requirements.

3.07 INSTALLATION OF SOUND RATED PARTITIONS

A. Provide sound-rated construction where indicated.

B. Acoustic Insulation: Install single layer of acoustic batt insulation in designated partitions after one side of gypsum board is installed, filling width and height of partition completely. Attach to gypsum board with adhesive spots to prevent subsequent displacement.

C. Extend partition stud system through acoustical ceilings to substrate. Apply

gypsum board base panels full height, both sides of partition.

D. 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 recommendations for locating edge trim and closing off sound-flanking paths around or through assemblies, including sealing partitions above acoustical ceilings.

E. Seal partition perimeters. Provide continuous beads of acoustical sealant at juncture of both faces of runners or plates with floor and ceiling construction and wherever work abuts dissimilar materials. Seal prior to installation of sound attenuation insulation and gypsum board panels.

F. Provide continuous beads of sealant at juncture of gypsum board and abutting surface. Install gypsum board with 1/8" relief for sealant. Sealants to be contained within depth of gypsum board, not as a fillet.

G. At openings and cutouts, fill open spaces between edges of gypsum board and fixtures, cabinets, ducts, and other flush or penetrating items, with continuous bead of acoustical sealant.

H. If sound-rated partitions intersect non-sound-rated partitions, extend sound construction to completely close-off sound flanking paths through non-rated construction. Seal joints between face layers at vertical interior angles of intersecting partitions.

I. Exercise particular care at walls surrounding toilet areas and walls and ceilings surrounding mechanical spaces to provide properly constructed sound-rated gypsum board partition and ceiling systems.

J. Verify that electrical boxes are not located back-to-back; back-to back boxes to be offset at least one stud space. Do not close off non-complying conditions before notifying and receiving direction from Architect.

3.08 TRIM AND ACCESSORIES

A. Install corner beads at external corners of gypsum wallboard and sheathing work. Use longest practical lengths.

B. Install edge trim wherever edge of gypsum board or sheathing would be exposed or semi-exposed.

1. Provide beaded trim to receive joint compound at all gypsum wallboard work.
2. Provide L-type trim where work is abutted to other work and Kerf-type where work is kerfed to receive kerf leg.
3. Provide U-type trim where edge is exposed, revealed, gasketed or sealant filled, including expansion joints.

C. Attach to framing with steel drill screws. Clinch attachment to wallboard not acceptable.

D. Control Joints

1. Install control joints to isolate gypsum board surfaces as recommended by ASTM C840. Verify locations with Architect prior to installation. Generally locate joints as follows when:
   a. Partition, furring or column fireproofing abuts a structural element (except floor) or dissimilar wall or ceiling.
   b. Ceiling abuts a structural element, dissimilar wall or partition or other vertical penetration.
   c. Construction changes within the plane of the partition or ceiling.
   d. Partition or furring run exceeds 30'.
   e. Ceiling dimensions exceed 50' in either direction with perimeter relief; 30' without relief.
   f. Exterior ceilings and soffits exceed 20' in either direction; align with window mullions, when applicable.
   g. Wings of "L", "U", and "T"-shaped ceiling areas are joined.
   h. Expansion or control joints occur in the base exterior wall.
   i. Differential Deflection Conditions: All locations where partitions are supported by two or more structural members and subject to differential deflection by live or dead loading:
      1) Typical Framing Floor to Structure: Provide "Ceiling Deflection Track".
      2) Framing over One Floor (stairs, shafts, etc.): Provide control joints where studs are interrupted by structure.
2. Provide framing immediately on both sides of joint and back with 2"+/- gypsum board strips as required to maintain fire resistance rating.

3.09 FINISHING

A. Comply with manufacturer's instructions for mixing, handling and application of materials. Apply treatment at joints both directions, at flanges of trim accessories, penetrations of gypsum board (electrical boxes, piping and similar work), fastener heads, surface defects and elsewhere indicated. Apply in manner that will result in each of these items being concealed when applied decoration has been completed.

B. Prefill open joints of more than 1/16" with special chemical-hardening type bedding compound, before bedding joint tape.

C. Apply joint tape at joints between gypsum boards, except where trim accessories are indicated.

D. Do not use topping compound for bedding joint tape.

E. Apply joint compound for the final coat of joint treatment, unless specifically

recommended by the manufacturer for that use.

F. Walls Above Acoustical Ceiling Systems: Tape and fill joints with two coats of joint compound, sanding not required.

G. Leave all exposed surfaces smooth and even, ready for painting.

H. Provide where indicated on the drawings levels of finish as specified in ASTM C840, "Recommended Specification on Levels of Gypsum Board Finish". Levels of finish consist of:

1. Level 1 - **Areas Above Ceilings**: All joints and interior angles shall have tape embedded in joint compound. Provide surface free of excess joint compound. Tool marks and ridges are acceptable.
2. Level 2 – **As a Substrate for Ceramic Tile**: All joints and interior angles to have tape embedded in joint compound and one separate coat of joint compound applied over all joints, angles, fastener heads, and accessories. Surface shall be free of excess joint compound. Tool marks and ridges are acceptable.
3. Level 4 – **All Areas Not Indicated to Receive Levels 1, 2 or 5**: All joints and interior angles to have tape embedded in joint compound and three separate coats of joint compound applied over all joints, angles, fastener heads, and accessories. All joint compound shall be smooth and free of tool marks and ridges.

3.10 ADJUST AND CLEAN

A. Remove any screw which does not engage into a framing member or spins freely.

B. When paper face is punctured, drive new screw approximately 1-1/2" from defective fastener and remove defective fastener. Fill damaged surface with compound.

C. Ridging

1. Do not repair ridging until condition has fully developed: approximately 6 months after installation or one heating season.
2. Sand ridges to reinforcing tape without cutting through tape.
3. Fill concave areas on both sides of ridge with topping compound.
4. After fill is dry, blend in topping compound over repaired area.

D. Fill cracks with compound and finish smooth and flush.

E. 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.

3.11 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.

END OF SECTION

SECTION 09 30 00

TILING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Tile for floor applications.

B. Tile for wall applications.

C. Ceramic trim.

D. Non-ceramic trim.

1.02 RELATED REQUIREMENTS

A. Section 03 5400 - Cast Gypsum Based Underlayment.

B. Section 07 1300 - Sheet Waterproofing.

C. Section 07 9005 - Joint Sealers.

D. Section 09 0561 - Common Work Results for Flooring Preparation: Concrete slab moisture and alkalinity testing and remediation procedures.

E. Section 09 2116 - Gypsum Board Assemblies: Tile backer board.

1.03 REFERENCE STANDARDS

A. ANSI A108/A118/A136 - American National Standard Specifications for the Installation of Ceramic Tile (Compendium) 2019.

B. ANSI A108/A118/A136.1 - American National Standard Specifications for the Installation of Ceramic Tile (Compendium). 2017.

C. ANSI A108.1a - American National Standard Specifications for Installation of Ceramic Tile in the Wet-Set Method, with Portland Cement Mortar 2017.

D. ANSI A108.1b - American National Standard Specifications for Installation of Ceramic Tile on a Cured Portland Cement Mortar Setting Bed with Dry-Set or Latex-Portland Cement Mortar 2017.

E. ANSI A108.1c - Specifications for Contractors Option: Installation of Ceramic Tile in the Wet-Set Method with Portland Cement Mortar or Installation of Ceramic Tile on a Cured Portland Cement Mortar Bed with Dry-Set or Latex-Portland Cement 1999 (Reaffirmed 2016).

F. ANSI A108.2 - American National Standard General Requirements: Materials, Environmental and Workmanship 2019.

G. ANSI A108.4 - American National Standard Specifications for Installation of Ceramic Tile with Organic Adhesives or Water Cleanable Tile-Setting Epoxy Adhesive 2009 (Revised).

H. ANSI A108.5 - American National Standard Specifications for Installation of Ceramic Tile with Dry-Set Portland Cement Mortar or Latex-Portland Cement Mortar 1999 (Reaffirmed 2010).

I. ANSI A108.6 - American National Standard Specifications for Installation of Ceramic Tile with Chemical Resistant, Water Cleanable Tile-Setting and -

Grouting Epoxy 1999 (Reaffirmed 2010).

J. ANSI A108.8 - American National Standard Specifications for Installation of Ceramic Tile with Chemical Resistant Furan Resin Mortar and Grout 1999 (Reaffirmed 2010).

K. ANSI A108.9 - American National Standard Specifications for Installation of Ceramic Tile with Modified Epoxy Emulsion Mortar/Grout 1999 (Reaffirmed 2010).

L. ANSI A108.10 - American National Standard Specifications for Installation of Grout in Tilework 2017.

M. ANSI A108.11 - American National Standard Specifications for Interior Installation of Cementitious Backer Units 2018.

N. ANSI A108/A118/A136.1 - American National Standard Specifications for the Installation of Ceramic Tile (Compendium). 2017.

O. ANSI A108.12 - American National Standard for Installation of Ceramic Tile with EGP (Exterior Glue Plywood) Latex-Portland Cement Mortar 1999 (Reaffirmed 2010).

P. ANSI A108.13 - American National Standard for Installation of Load Bearing, Bonded, Waterproof Membranes for Thin-Set Ceramic Tile and Dimension Stone 2005 (Reaffirmed 2016).

Q. ANSI A108.19 - American National Standard Specifications for Interior Installation of Gauged Porcelain Tiles and Gauged Porcelain Tile Panels/Slabs by the Thin-Bed Method Bonded with Modified Dry-Set Cement Mortar or Improved Modified Dry-Set Cement Mortar 2017.

R. ANSI A118.3 - American National Standard Specifications for Chemical Resistant, Water Cleanable Tile-Setting and -Grouting Epoxy and Water Cleanable Tile-Setting Epoxy Adhesive 2013 (Revised).

S. ANSI A118.4 - American National Standard Specifications for Modified Dry-Set Cement Mortar 2012 (Revised).

T. ANSI A118.7 - American National Standard Specifications for High Performance Cement Grouts for Tile Installation 2010 (Reaffirmed 2016).

U. ANSI A108/A118/A136.1 - American National Standard Specifications for the Installation of Ceramic Tile (Compendium). 2017.

V. ANSI A118.10 - American National Standard Specifications for Load Bearing, Bonded, Waterproof Membranes For Thin-Set Ceramic Tile And Dimension Stone Installation 2014.

W. ANSI A118.12 - American National Standard Specifications for Crack Isolation Membranes for Thin-Set Ceramic Tile and Dimension Stone Installation 2014.

X. ANSI A118.15 - American National Standard Specifications for Improved Modified Dry- Set Cement Mortar 2012.

Y. ANSI A137.1 - American National Standard Specifications for Ceramic Tile 2019.

Z. ASTM C1178/C1178M - Standard Specification for Coated Glass Mat Water-Resistant Gypsum Backing Panel 2018.

AA. TCNA (HB) - Handbook for Ceramic, Glass, and Stone Tile Installation 2019.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturers' data sheets on tile, mortar, grout, and accessories. Include instructions for using grouts and adhesives.

C. Shop Drawings: Indicate tile layout, patterns, color arrangement, perimeter conditions, junctions with dissimilar materials, control and expansion joints, thresholds, ceramic accessories, and setting details.

D. Samples: submit two samples of each color as selected by architect

E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 6000 - Product Requirements, for additional provisions.
   2. Maintenance Data: Include recommended cleaning methods, cleaning materials, stain removal methods, and polishes and waxes.

1.05 QUALITY ASSURANCE

A. Maintain one copy of and ANSI A108/A118/A136.1 and TCNA (HB) on site.

B. Manufacturer Qualifications: Company specializing in manufacturing the types of products specified in this section, with minimum five years of documented experience.

C. Installer Qualifications: Company specializing in performing tile installation, with minimum of five years of documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Protect adhesives from freezing or overheating in accordance with manufacturer's instructions.

1.07 FIELD CONDITIONS

A. Do not install solvent-based products in an unventilated environment.

B. Maintain ambient and substrate temperature above 50 degrees F and below 100 degrees F during installation and curing of setting materials.

PART 2 PRODUCTS

2.01 TILE

A. Common Areas & Resident Units: American Olean, Windmere. Color TBD. Field tile sizes: 12x24" floor tile, 4" x 12" wall tile, 2" x 2" mosaic; Bullnose 3"X12" trim to match.
   1. Manufacturers: As indicated on the drawings. .
      a. American Olean Corporation: www.americanolean.com/#sle.
      b. Dal-Tile Corporation: www.daltile.com/#sle.
      c. Emser Tile, LLC: www.emser.com/#sle.
   2. Ceramic Mosaic Tile, Type PORCELAIN:
      a. Color(s): As indicated on drawings.
      b. Products:
         1) Dal-Tile Corporation: www.daltile.com/#sle.
         2) American Olean; www.americanolean.com.

2.02 TRIM AND ACCESSORIES

A. Ceramic Trim: Matching bullnose, double bullnose, cove base, and cove ceramic shapes in sizes coordinated with field tile.
   1. Manufacturers: Same as for tile.

B. Non-Ceramic Trim: Satin brass anodized extruded aluminum, style and dimensions to suit application, for setting using tile mortar or adhesive.
   1. Applications:
      a. Open edges of wall tile.
      b. Open edges of floor tile.
      c. Wall corners, outside and inside.
      d. Transition between floor finishes of different heights.
      e. Thresholds at door openings.
      f. Expansion and control joints, floor and wall.
      g. Floor to wall joints.
      h. Borders and other trim as indicated on drawings.
   2. Manufacturers:
      a. Schluter-Systems: www.schluter.com/#sle.
      b. Substitutions: See Section 01 6000 - Product Requirements.

2.03 SETTING MATERIALS

A. Provide setting and grout materials from same manufacturer.

B. Manufacturers:
   1. ARDEX Engineered Cements: www.ardexamericas.com/#sle.
   2. Bostik Inc: www.bostik-us.com/#sle.
   3. Custom Building Products: www.custombuildingproducts.com/#sle.
   4. LATICRETE International, Inc: www.laticrete.com/#sle.
   5. Mapei: www.mapei.com

C. Provide setting materials made by the same manufacturer as grout.

D. Latex-Portland Cement Mortar Bond Coat:
   1. Applications: Use this type of bond coat where indicated and where no other type of bond coat is indicated.
   2. Products:
      a. ARDEX Engineered Cements; ARDEX X 77 MICROTEC: www.ardexamericas.com.
      b. AVM Industries, Inc; Thin-Set 780: www.avmindustries.com.
      c. LATICRETE International, Inc; LATICRETE 254 Platinum: www.laticrete.com.
      d. Merkrete, by Parex USA, Inc; Merkrete 735 Premium Flex: www.merkrete.com/sle.
      e. ProSpec, an Oldcastle brand; Permalastic System: www.prospec.com.

2.04 GROUTS

A. Manufacturers:
   1. ARDEX Engineered Cements: www.ardexamericas.com/#sle.
   2. ProSpec, an Oldcastle brand; ProColor Sanded Tile Grout: www.prospec.com.
   3. Bostik Inc: www.bostik-us.com/#sle.
   4. LATICRETE International, Inc; LATICRETE PERMACOLOR Grout: www.laticrete.com/#sle.

5. Merkrete, by Parex USA, Inc; Merkrete Duracolor Non-Sanded Color Grout: www.merkrete.com/#sle.
6. Mapei; www.mapei.com.

B. High Performance Polymer Modified Grout: ANSI A118.7 polymer modified cement grout.
1. Applications: Use this type of grout where indicated and where no other type of grout is indicated.
2. Use sanded grout for joints 1/8 inch wide and larger; use unsanded grout for joints less than 1/8 inch wide.
3. Color(s): As indicated on drawings.
4. Products:
   a. ARDEX Engineered Cements; ARDEX FG-C MICROTEC: www.ardexamericas.com.
   b. Bostik Inc: www.bostik-us.com.
   c. LATICRETE International, Inc; LATICRETE PERMACOLOR Grout: www.laticrete.com/#sle.
   d. Merkrete, by Parex USA, Inc; Merkrete Pro Grout: www.merkrete.com/#sle.
   e. ProSpec, an Oldcastle brand; ProColor Sanded Tile Grout: www.prospec.com.
   f. Substitutions: See Section 01 6000 - Product Requirements.

C. Epoxy Grout: ANSI A118.3 chemical resistant and water-cleanable epoxy grout.
1. Applications: Where indicated.
2. Color(s): As selected by Architect from manufacturer's full line.
3. Products:
   a. Bostik Inc: www.bostik-us.com.
   b. LATICRETE International, Inc; LATICRETE SPECTRALOCK PRO Premium Grout: www.laticrete.com/#sle.
   c. Merkrete, by Parex USA, Inc; Merkrete Pro Epoxy: www.merkrete.com/#sle.
   d. ProSpec, an Oldcastle brand; B-7000 Epoxy Mortar and Grout: www.prospec.com.
   e. Stuart Dean Company, Inc; Marcoat GS: www.stuartdean.com/#sle.
   f. Substitutions: See Section 01 6000 - Product Requirements.

D. Stain Resistant Grout Additive: Liquid admixture for sanded and unsanded cement- based grouts; mix with dry grout material in place of water.
1. Applications: throughout.
2. Products:
   a. ProSpec, an Oldcastle brand; ProColor Stain Guard Grout Additive: www.prospec.com.
   b. H.B. Fuller Construction Products Inc. Grout Boost Advanced Pro; www.groutboost.com.
   c. Substitutions: See Section 01 6000 - Product Requirements.

E. Tile Sealant: Gunnable, silicone, siliconized acrylic, or urethane sealant; moisture and mildew resistant type.
1. Applications: Between tile and plumbing fixtures.
2. Color(s): As selected by Architect from manufacturer's full line.
3. Products:

a. ARDEX Engineered Cements; ARDEX SX: www.ardexamericas.com.
b. LATICRETE International, Inc; LATICRETE LATASIL: www.laticrete.com.
c. Merkrete, by Parex USA, Inc; Merkrete Colored Caulking: www.merkrete.com.
d. ProSpec, an Oldcastle brand; ProColor Advantage Caulk: www.prospec.com.
e. Substitutions: See Section 01 6000 - Product Requirements.

F. Grout Sealer: Liquid-applied, moisture and stain protection for existing or new Portland cement grout.
1. Composition: Water-based colorless silicone.
2. Color(s): As selected by Architect from manufacturer's full line.

2.05 MAINTENANCE MATERIALS

A. Tile Sealant: Gunnable, silicone, siliconized acrylic, or urethane sealant; moisture and mildew resistant type.
1. Applications: Between tile and plumbing fixtures.
2. Color(s): As selected by Architect from manufacturer's full line.

B. Grout Sealer: Liquid-applied, moisture and stain protection for existing or new Portland cement grout.
1. Composition: Water-based colorless silicone.

2.06 ACCESSORY MATERIALS

A. Concrete Floor Slab Crack Isolation Membrane: Material complying with ANSI A118.12; not intended as waterproofing.
1. Thickness: 20 mils, maximum.
2. Crack Resistance: No failure at 1/8 inch gap, minimum.
3. Products:
a. LATICRETE International, Inc; LATICRETE Blue 92 Anti-Fracture Membrane: www.laticrete.com/#sle.
b. Merkrete, by Parex USA, Inc; Merkrete Fracture Guard: www.merkrete.com/#sle.
c. Substitutions: See Section 01 6000 - Product Requirements.

B. Waterproofing Membrane at Floors: Specifically designed for bonding to cementitious substrate under thick mortar bed or thin-set tile; complying with ANSI A118.10.
1. Type: Bonded Sheet Membrane.

C. Cementitious Backer Board: ANSI A118.9; High density, cementitious, glass fiber reinforced, 1/2 inch thick; 2 inch wide coated glass fiber tape for joints and corners. See Section 092116.

D. Coated Glass Mat Backer Board: ASTM C1178/C1178M, with coated inorganic fiberglass mat on both surfaces and integral acrylic coating vapor retarder. See Section 092116.

E. Mesh Tape: 2 inch wide self-adhesive fiberglass mesh tape.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that subfloor surfaces are smooth and flat within the tolerances specified for that type of work and are ready to receive tile.

B. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive tile.

C. Verify that subfloor surfaces are dust free and free of substances that could impair bonding of setting materials to subfloor surfaces.

D. Verify that concrete sub-floor surfaces are ready for tile installation by testing for moisture emission rate and alkalinity; obtain instructions if test results are not within limits recommended by tile manufacturer and setting materials manufacturer.

3.02 PREPARATION

A. Protect surrounding work from damage.

B. Vacuum clean surfaces and damp clean.

C. Seal substrate surface cracks with filler. Level existing substrate surfaces to acceptable flatness tolerances.

D. Install backer board in accordance with ANSI A108.11 and board manufacturer's instructions. Tape joints and corners, cover with skim coat of setting material to a feather edge.

E. Prepare substrate surfaces for adhesive installation in accordance with adhesive manufacturer's instructions.

3.03 INSTALLATION - GENERAL

A. Install tile, thresholds, and stair treads and grout in accordance with applicable requirements of ANSI A108.1a through ANSI A108.19 , manufacturer's instructions, and TCNA (HB) recommendations.

B. Lay tile to pattern indicated. Do not interrupt tile pattern through openings.

C. Cut and fit tile to penetrations through tile, leaving sealant joint space. Form corners and bases neatly. Align floor joints.

D. Place tile joints uniform in width, subject to variance in tolerance allowed in tile size. Make grout joints without voids, cracks, excess mortar or excess grout, or too little grout.

E. Form internal angles square and external angles bullnosed.

F. Install non-ceramic trim in accordance with manufacturer's instructions.

G. Sound tile after setting. Replace hollow sounding units.

H. Keep control and expansion joints free of mortar, grout, and adhesive.

I. Keep expansion joints free of adhesive or grout. Apply sealant to joints.

J. Prior to grouting, allow installation to completely cure; minimum of 48 hours.

K. Grout tile joints unless otherwise indicated. Use standard grout unless otherwise indicated.

L. At changes in plane and tile-to-tile control joints, use tile sealant instead of grout, with either bond breaker tape or backer rod as appropriate to prevent three-sided bonding.

M. Apply sealant to junction of tile and dissimilar materials and junction of dissimilar planes.

3.04 INSTALLATION - FLOORS - THIN-SET METHODS

A. Over exterior concrete substrates, install in accordance with TCNA (HB)

Method F102, with standard grout.

B. Over interior concrete substrates, install in accordance with TCNA (HB) Method F113, dry-set or latex-Portland cement bond coat, with standard grout, unless otherwise indicated.
   1. Use uncoupling membrane under all tile unless other underlayment is indicated.
   2. Where waterproofing membrane is indicated, install in accordance with TCNA (HB) Method F122, with latex-Portland cement grout.

C. Over wood substrates, install in accordance with TCNA (HB) Method F142, with standard grout, unless otherwise indicated.

D. Over wood substrate with backer board underlayment, install in accordance with TCNA (HB) Method F144, for cementitious backer boards, with standard grout.

3.05 INSTALLATION - SHOWERS AND BATHTUB WALLS

A. At tiled shower receptors install in accordance with TCNA (HB) Method B415, mortar bed floor, and W244, thin-set over cementitious backer unit walls.

B. At bathtub walls install in accordance with TCNA (HB) Method B412, over cementitious backer units with waterproofing membrane.

C. Grout with standard grout as specified above.

D. Seal joints between tile work and other work with silicone type sealant specified in Section 07 9005.

3.06 INSTALLATION - WALL TILE

A. Over cementitious backer units on studs, install in accordance with TCNA (HB) Method W244, using membrane at toilet rooms.

B. Over coated glass mat backer board on studs, install in accordance with TCNA (HB) Method W245.

C. Over gypsum wallboard on wood or metal studs install in accordance with TCNA (HB) Method W243, thin-set with dry-set or latex-Portland cement bond coat, unless otherwise indicated.

D. Over wood studs without backer install in accordance with TCNA (HB) Method W231, mortar bed, with membrane where indicated.

3.07 CLEANING

A. Clean tile and grout surfaces.

3.08 PROTECTION

A. Do not permit traffic over finished floor surface for 4 days after installation.

END OF SECTION

SECTION 09 51 00

ACOUSTICAL CEILINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Suspended metal grid ceiling system.

B. Acoustical units.

1.02 RELATED REQUIREMENTS

A. Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions.

B. Section 07 2100 - Thermal Insulation: Acoustical insulation.

C. Section 08 3100 - Access Doors and Panels: Access panels.

D. Section 21 1300 - Fire-Suppression Sprinkler Systems: Sprinkler heads in ceiling system.

E. Section 23 3700 - Air Outlets and Inlets: Air diffusion devices in ceiling.

F. Section 26 5100 - Interior Lighting: Light fixtures in ceiling system.

G. Section 27 5116 - Public Address Systems: Speakers in ceiling system.

H. Section 28 4600 - Fire Detection and Alarm: Fire alarm components in ceiling system.

1.03 REFERENCE STANDARDS

A. ASTM C635/C635M - Standard Specification for the Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings 2017.

B. ASTM C636/C636M - Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels 2013.

C. ASTM E580/E580M - Standard Practice for Installation of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Subject to Earthquake Ground Motions 2020.

D. ASTM E1264 - Standard Classification for Acoustical Ceiling Products 2019.

E. CAL (CHPS LEM) - Low-Emitting Materials Product List; California Collaborative for High Performance Schools (CHPS); current edition at www.chps.net/.

F. GEI (SCH) - GREENGUARD "Children and Schools" Certified Products Current Edition.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate grid layout and related dimensioning.

C. Product Data: Provide data on suspension system components and acoustical units.

D. Samples: Submit two samples 6 by 6 inch in size illustrating material and

finish of acoustical units.

1.05 QUALITY ASSURANCE

A. Suspension System Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

B. Acoustical Unit Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Acoustical Tiles/Panels:
   1. Armstrong World Industries, Inc: www.armstrong.com.
   2. Acoustic Ceiling Products, Inc: www.acpideas.com.
   3. CertainTeed Corporation: www.certainteed.com.
   4. USG: www.usg.com.
   5. Substitutions: See Section 01 6000 - Product Requirements.

B. Suspension Systems:
   1. Same as for acoustical units.

2.02 ACOUSTICAL UNITS

A. Manufacturers:
   1. Acoustical Tile: Basis-of-Design Product: Subject to compliance with requirements, provide Suprafine by Armstrong with DUNE Second Look II 24" x 48", white, or comparable product by one of the following
   2. Acoustical Tile: Basis-of-Design Product: Subject to compliance with requirements, provide Suprafine by Armstrong with Calla 24" x 24", white, or comparable product by one of the following
   3.
      a. Basis of Design Armstrong World Industries, Inc: www.armstrong.com.
      b. Acoustic Ceiling Products, Inc.: www.acpideas.com.
      c. CertainTeed Corporation: www.certainteed.com.
      d. USG: www.usg.com.
      e. Substitutions: See Section 01 6000 - Product Requirements.

B. Acoustical Units - General: ASTM E1264,type III Class A.
   1. Flame Spread Rating: 25 or less (ASTM E84). To meet Federal Spec. SS- S-118a, Class 25.
   2. Comply with "Acoustical and Insulating Materials Association" (AIMA) "Performance Data Bulletin".
   3. Provide panels that are sag resistant and manufactured for environment with humidity levels up to 100%.
   4. Edge: Beveled tegular.
   5. Surface Color: White.
   6. VOC Content: Certified as Low Emission by one of the following :
      a. GreenGuard Children and Schools; www.greenguard.org.
      b. Product listing in the CHPS Low-Emitting Materials Product List at; www.chps.net/manual/lem_table.htm.

2.03 SUSPENSION SYSTEM(S)

A. Manufacturers:
   1. Armstrong World Industries, Inc: www.armstrong.com.
   2. Acoustic Ceiling Products, Inc.: www.acpideas.com.
   3. CertainTeed Corporation: www.certainteed.com.
   4. Chicago Metallic Corporation: www.chicagometallic.com.
   5. Hunter Douglas Contract: www.hunterdouglascontract.com.
   6. USG: www.usg.com.
   7. Substitutions: See Section 01 6000 - Product Requirements.

B. Metal Suspension Systems - General: Complying with ASTM C635/C635M; die cut and interlocking components, with perimeter moldings, hold down clips, stabilizer bars, clips, and splices as required.

C. Exposed Steel Suspension System: Formed steel, commercial quality cold rolled; heavy-duty.
   1. Finish: White painted.

2.04 ACCESSORIES

A. Support Channels and Hangers: Galvanized steel; size and type to suit application, seismic requirements, and ceiling system flatness requirement specified.

B. Hanger Wire: 12 gauge, 0.08 inch galvanized steel wire.

C. Perimeter Moldings: Same metal and finish as grid.
   1. At Exposed Grid: Provide L-shaped molding for mounting at same elevation as face of grid.

D. Touch-up Paint: Type and color to match acoustical and grid units.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that layout of hangers will not interfere with other work.

3.02 INSTALLATION - SUSPENSION SYSTEM

A. Install suspension system in accordance with ASTM C636/C636M, ASTM E580/E580M, ASTM C636/C636M, ASTM E580/E580M, ASTM C636/C636M, and ASTM E580/E580M and as supplemented in this section.

B. Rigidly secure system, including integral mechanical and electrical components, for maximum deflection of 1:360.

C. Lay out system to a balanced grid design with edge units no less than 50 percent of acoustical unit size.

D. Perimeter Molding: Install at intersection of ceiling and vertical surfaces and at junctions with other interruptions.
   1. Use longest practical lengths.

E. Install after major above-ceiling work is complete. Coordinate the location of hangers with other work.

F. Suspension System, Non-Seismic: Hang suspension system independent of walls, columns, ducts, pipes and conduit. Where carrying members are

spliced, avoid visible displacement of face plane of adjacent members.

G. Where ducts or other equipment prevent the regular spacing of hangers, reinforce the nearest affected hangers and related carrying channels to span the extra distance.

H. Do not support components on main runners or cross runners if weight causes total dead load to exceed deflection capability.

I. Support fixture loads using supplementary hangers located within 6 inches of each corner, or support components independently.

J. Do not eccentrically load system or induce rotation of runners.

K. Perimeter Molding: Install at intersection of ceiling and vertical surfaces and at junctions with other interruptions.
   1. Use longest practical lengths.
   2. Overlap and rivet corners.

3.03 INSTALLATION - ACOUSTICAL UNITS

A. Install acoustical units in accordance with manufacturer's instructions.

B. Fit acoustical units in place, free from damaged edges or other defects detrimental to appearance and function.

C. Fit border trim neatly against abutting surfaces.

D. Install units after above-ceiling work is complete.

E. Install acoustical units level, in uniform plane, and free from twist, warp, and dents.

F. Cutting Acoustical Units:
   1. Cut to fit irregular grid and perimeter edge trim.
   2. Make field cut edges of same profile as factory edges.

3.04 ATTIC STOCK

A. Provide one additional box of replacement acoustical ceiling tile to the owner for future use.

3.05 TOLERANCES

A. Maximum Variation from Flat and Level Surface: 1/8 inch in 10 feet.

B. Maximum Variation from Plumb of Grid Members Caused by Eccentric Loads: 2 degrees.

END OF SECTION

SECTION 09 65 00

RESILIENT FLOORING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Resilient sheet flooring.

B. Resilient tile flooring.

C. Resilient base.

D. Resilient stair accessories.

1.02 RELATED REQUIREMENTS

A. Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions.

B. Section 09 0561 - Common Work Results for Flooring Preparation: Removal of existing floor coverings, cleaning, and preparation.

C. Section 09 0561 - Common Work Results for Flooring Preparation: Concrete slab moisture and alkalinity testing and remediation procedures.

1.03 REFERENCE STANDARDS

A. ASTM E648 - Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source 2019a, with Editorial Revision (2020).

B. ASTM E2179 - Standard Test Method for Laboratory Measurement of the Effectiveness of Floor Coverings in Reducing Impact Sound Transmission Through Concrete Floors 2003 (Reapproved 2016).

C. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring 2019, with Editorial Revision (2020).

D. ASTM F1066 - Standard Specification for Vinyl Composition Floor Tile 2004 (Reapproved 2018).

E. ASTM F1303 - Standard Specification for Sheet Vinyl Floor Covering with Backing 2004 (Reapproved 2014).

F. ASTM F1861 - Standard Specification for Resilient Wall Base 2016.

G. ASTM F1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride 2016a.

H. ASTM F1913 - Standard Specification for Vinyl Sheet Floor Covering Without Backing 2019.

I. ASTM F2034 - Standard Specification for Sheet Linoleum Floor Covering 2018.

J. ASTM F2170 - Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes 2019a.

K. FS RR-T-650 - Treads, Metallic and Nonmetallic, Skid Resistant; Federal Specifications and Standards; Revision E, 1994.

L. NFPA 253 - Standard Method of Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source 2019.

M. RFCI (RWP) - Recommended Work Practices for Removal of Resilient Floor Coverings 2011.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on specified products, describing physical and performance characteristics; including sizes, patterns and colors available; and installation instructions.

C. Shop Drawings: Indicate seaming plans and floor patterns.

D. Selection Samples: Submit manufacturer's complete set of color samples for Architect's initial selection.

E. Verification Samples: Submit two samples, 6 x 9 inch in size illustrating color and pattern for each resilient flooring product specified. For heat welding rod, submit manufacturer's standard sixe, but not less than 9 inches long, of each color specified.

F. Sustainable Design Submittal: Submit VOC content documentation for flooring and adhesives.

G. Concrete Subfloor Test Report: Submit a copy of the moisture and alkalinity (pH) test reports.

H. Certification: Prior to installation of flooring, submit written certification by flooring manufacturer and adhesive manufacturer that condition of subfloor is acceptable.

I. Manufacturer's Qualification Statement.

J. Installer's Qualification Statement.

K. Maintenance Data: Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning, stripping, and re-waxing.

L. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. See Section 01 6000 - Product Requirements, for additional provisions.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing specified flooring with minimum three years documented experience.

B. Installer Qualifications: Company specializing in installing specified flooring with minimum three years documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Upon receipt, immediately remove any shrink-wrap and check materials for damage and the correct style, color, quantity and run numbers.

B. Store all materials off of the floor in an acclimatized, weather-tight space.

C. Maintain temperature in storage area between 55 degrees F and 90 degrees F.

D. Protect roll materials from damage by storing on end.

E. Do not double stack pallets.

1.07 FIELD CONDITIONS

A. Maintain temperature in storage area between 55 degrees F and 90 degrees F.

B. Store materials for not less than 48 hours prior to installation in area of installation at a temperature of 70 degrees F to achieve temperature stability. Thereafter, maintain conditions above 55 degrees F.

PART 2 PRODUCTS

2.01 SHEET FLOORING

A. Resident Units:
   1. Patcraft, Cosmos SV I460V Creation SV 12, 110 Existence
   2. Contact Manufacturer's Representative: Tom Conway 503-307-4592, tom.conway@patcraft.com
   3. Vinyl Sheet Flooring: Homogeneous without backing, with color and pattern throughout full thickness.
      a. Minimum Requirements: Comply with ASTM F1913.
      b. Critical Radiant Flux (CRF): Minimum 0.45 watt per square centimeter, when tested in accordance with ASTM E 648, NFPA 253, ASTM E 648, or NFPA 253.
      c. Thickness: 0.080 inch nominal.
      d. Sheet Width: 120 inch minimum.
      e. Seams: Chemically bonded using seam sealer.
      f. Color: As indicated on drawings.

2.02 TILE FLOORING

A. Vinyl Compositionm Tile (VCT):
   1. Common Areas (IT Room, Storage Rooms, Janitor, Maintenance, Mechanical Closets) see finish schedule: Armstrong, Standard Excelon, Imperial Texture.

B. Vinyl Composition Tile (VCT): Homogeneous, with color extending throughout thickness, and:
   1. Manufacturers:
      a. Armstrong Flooring, Inc; Excelon SDT: www.armstrongflooring.com/#sle.
   2. Minimum Requirements: Comply with ASTM F1066, of Class corresponding to type specified.
   3. Critical Radiant Flux (CRF): Minimum 0.45 watt per square centimeter, when tested in accordance with ASTM E 648, NFPA 253, ASTM E 648, or NFPA 253.
   4. Size: 12 by 12 inch.
   5. Thickness: 0.125 inch.
   6. Color: As indicated on drawings.

C. Luxury Vinyl Tile (LVT) A.K.A. Vinyl Plank (VP):
   1. Common Areas (see finish schedule for locations): Patcraft Heartwood 20 LVT Froe
   2. Resident Units: Patcraft, Heartwood LVT Froe
   3. Contact Manufacturer's Representative: Tom Conway 503-307-4592, tom.conway@patcraft.com.

D. Feature Strips: Of same material as tile.

2.03 STAIR COVERING

A. Stair Tread / Riser Combination: Rubber tread with integrated riser for the

visuially impaired; full width and depth of stair tread in one piece; tapered thickness; nosing not less than 1-5/8 inch deep. Basis of Design is Tarkett. Product: Standard raised round tread/riser. :

1. Manufacturers:
   a. Burke Flooring; Endura Stair Treads: www.burkeflooring.com/#sle.
   b. Tarkett; www.tarkett.com
   c. Roppe Corp: www.roppe.com/#sle.
   d. Substitutions: See Section 01 6000 - Product Requirements.
2. Minimum Requirements: Comply with FS RR-T-650 requirements corresponding to type specified.
3. Critical Radiant Flux (CRF): Minimum 0.45 watt per square centimeter, when tested in accordance with ASTM E 648, NFPA 253, ASTM E 648, or NFPA 253.
4. Nominal Thickness: 0.1875 inch.
5. Nosing: Square.
6. Striping: 2 inch wide contrasting color abrasive strips.
7. Texture: to be reviewed by Architect from manufacturer's full range of textures..
8. Color: As indicated on drawings.

2.04 RESILIENT BASE

A. Resilient Base: ASTM F1861, Type TS rubber, vulcanized thermoset; top set Style B, Cove.
   1. Manufacturers:
      a. Burke Flooring; Commercial Wall Base - TS: www.burkeflooring.com/#sle.
      b. Tarkett; www.tarkett.com
      c. Roppe Corp: www.roppe.com/#sle.
      d. Patcraft; https://www.patcraft.com/app/Accessories.
      e. Substitutions: See Section 01 6000 - Product Requirements.
   2. Height: 4 inch.
   3. Thickness: 0.125 inch.
   4. Finish: Satin.
   5. Color: As indicated on drawings.
   6. Accessories: Premolded external corners and internal corners.

2.05 ACCESSORIES

A. Subfloor Filler: White premix latex; type recommended by adhesive material manufacturer.

B. Primers, Adhesives, and Seam Sealer: Waterproof; types recommended by flooring manufacturer.

C. Moldings, Transition and Edge Strips: As indicated on drawings..
   1. Manufacturers:
      a. Burke Flooring; Mercer Vinyl Mouldings: www.burkeflooring.com/#sle.
      b. Substitutions: See Section 01 6000 - Product Requirements.

D. Filler for Coved Base: Plastic.

E. Sealer and Wax: Types recommended by flooring manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that surfaces are flat to tolerances acceptable to flooring manufacturer, free of cracks that might telegraph through flooring, clean, dry, and free of curing compounds, surface hardeners, and other chemicals that might interfere with bonding of flooring to substrate.

B. Verify that wall surfaces are smooth and flat within the tolerances specified for thattype of work, are dust-free, and are ready to receive resilient base.

C. Cementitious Subfloor Surfaces: Verify that substrates are ready for resilient flooring installation by testing for moisture and alkalinity (pH).
   1. Test in accordance with Section 09 0561.
   2. Test as Follows:
      a. Alkalinity (pH): ASTM F710.
      b. Internal Relative Humidity: ASTM F2170.
      c. Moisture Vapor Emission: ASTM F1869.
   3. Obtain instructions if test results are not within limits recommended by resilient flooring manufacturer and adhesive materials manufacturer.

D. Verify that required floor-mounted utilities are in correct location.

3.02 PREPARATION

A. Remove existing resilient flooring and flooring adhesives; follow the recommendations of RFCI (RWP).

B. Prepare floor substrates as recommended by flooring and adhesive manufacturers.

C. Remove subfloor ridges and bumps. Fill minor low spots, cracks, joints, holes, and other defects with subfloor filler to achieve smooth, flat, hard surface.

D. Prohibit traffic until filler is fully cured.

3.03 INSTALLATION - GENERAL

A. Starting installation constitutes acceptance of subfloor conditions.

B. Install in accordance with manufacturer's written instructions.

C. Adhesive-Applied Installation: Install in accordance with manufacturer's written instructions.

D. Loose-Laid Installation: Set flooring in place in accordance with manufacturer's instructions.

E. Where type of floor finish, pattern, or color are different on opposite sides of door, terminate flooring under centerline of door.

F. Install edge strips at unprotected or exposed edges, where flooring terminates, and where indicated.
   1. Metal Strips: Attach to substrate before installation of flooring using stainless steel screws.
   2. Resilient Strips: Attach to substrate using adhesive.

G. Spread only enough adhesive to permit installation of materials before initial set.

H. Fit joints and butt seams tightly.

I. Set flooring in place, press with heavy roller to attain full adhesion.

J. Where type of floor finish, pattern, or color are different on opposite sides

of door, terminate flooring under centerline of door.

K. Install edge strips at unprotected or exposed edges, where flooring terminates, and where indicated.

L. Scribe flooring to walls, columns, cabinets, floor outlets, and other appurtenances to produce tight joints.

M. Install feature strips where indicated.

3.04 INSTALLATION - TILE FLOORING

A. Mix tile from container to ensure shade variations are consistent when tile is placed, unless otherwise indicated in manufacturer's installation instructions.

B. Lay flooring with joints and seams parallel to building lines to produce symmetrical pattern.

3.05 INSTALLATION - RESILIENT BASE

A. Fit joints tightly and make vertical. Maintain minimum dimension of 18 inches between joints.

B. Miter internal corners. At external corners, use premolded units. At exposed ends, use premolded units.

C. Install base on solid backing. Bond tightly to wall and floor surfaces.

D. Scribe and fit to door frames and other interruptions.

3.06 INSTALLATION - STAIR COVERINGS

A. Install stair coverings in one piece for full width and depth of tread.

B. Adhere over entire surface. Fit accurately and securely.

3.07 CLEANING

A. Remove excess adhesive from floor, base, and wall surfaces without damage.

B. Clean in accordance with manufacturer's written instructions.

3.08 PROTECTION

A. Prohibit traffic on resilient flooring for 48 hours after installation.

END OF SECTION

SECTION 09 68 13

TILE CARPETING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Carpet tile, fully adhered.

1.02 REFERENCE STANDARDS

A. ASTM E648 - Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source 2019a, with Editorial Revision (2020).

B. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring 2019, with Editorial Revision (2020).

C. CRI 104 - Standard for Installation of Commercial Carpet 2015.

D. CRI (GLP) - Green Label Plus Testing Program - Certified Products Current Edition.

E. NFPA 253 - Standard Method of Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source 2019.

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate layout of joints.

C. Product Data: Provide data on specified products, describing physical and performance characteristics; sizes, patterns, colors available, and method of installation.

D. Samples: Submit one carpet tile illustrating color and pattern design for each carpet color selected.

E. LEED Report: Submit data documenting VOC content of carpet tile and adhesives; copy of current CRI Approved Products Listing is acceptable.

F. Manufacturer's Installation Instructions: Indicate special procedures.

1.04 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in installing carpet tile with minimum three years documented experience and approved by carpet tile manufacturer.

1.05 FIELD CONDITIONS

A. Store materials in area of installation for minimum period of 24 hours prior to installation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Tile Carpeting:

1. Patcraft. Contact Manufacturer's Representative: Tom Conway 503-307-4592, tom.conway@patcraft.com.

2.02 MATERIALS

A. Tile Carpeting: Tufted, manufactured in one color dye lot.
   1. Product: Passage, Step manufactured by Patcraft. Installed as indicated on the drawings.

B. Tile Carpeting: Tufted, manufactured in one color dye lot.
   1. Product: Prodigy, Wisdom manufactured by Patcraft. Installed in common areas as indicated on the drawings.

2.03 ACCESSORIES

A. Edge Strips: Embossed aluminum, color as selected by Architect.

B. Carpet Tile Adhesive: Recommended by carpet tile manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that subfloor surfaces are smooth and flat within tolerances specified for that type of work and are ready to receive carpet tile.

B. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive carpet tile.

C. Verify that subfloor surfaces are dust-free and free of substances that could impair bonding of adhesive materials to subfloor surfaces.

D. Cementitious Subfloor Surfaces: Verify that substrates are ready for flooring installation by testing for moisture and alkalinity (pH).
   1. Obtain instructions if test results are not within limits recommended by flooring material manufacturer and adhesive materials manufacturer.
   2. Follow moisture and alkalinity remediation procedures in Section 09 0561.

E. Verify that required floor-mounted utilities are in correct location.

3.02 PREPARATION

A. Prepare floor substrates as recommended by flooring and adhesive manufacturers.

3.03 INSTALLATION

A. Starting installation constitutes acceptance of subfloor conditions.

B. Install carpet tile in accordance with manufacturer's instructions.

C. Blend carpet from different cartons to ensure minimal variation in color match.

D. Cut carpet tile clean. Fit carpet tight to intersection with vertical surfaces without gaps.

E. Lay carpet tile in square pattern, with pile direction parallel to next unit, set parallel to building lines.

F. Fully adhere carpet tile to substrate.

G. Trim carpet tile neatly at walls and around interruptions.

H. Complete installation of edge strips, concealing exposed edges.

3.04 CLEANING

A. Remove excess adhesive without damage, from floor, base, and wall surfaces.

B. Clean and vacuum carpet surfaces.

END OF SECTION

SECTION 09 68 16

SHEET CARPETING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Carpet, direct-glued.

B. Accessories.

1.02 REFERENCE STANDARDS

A. ASTM D2859 - Standard Test Method for Ignition Characteristics of Finished Textile Floor Covering Materials 2016.

B. CRI 104 - Standard for Installation of Commercial Carpet 2015.

C. CRI (CIS) - Carpet Installation Standard; Carpet and Rug Institute; 2009.

D. CRI (GLA) - Green Label Testing Program - Approved Adhesive Products; Carpet and Rug Institute; Current Edition.

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate seaming plan, method of joining seams, direction of carpet pile and pattern, location of edge moldings and edge bindings, layout of flat wire system.

C. Product Data: Provide data on specified products, describing physical and performance characteristics; sizes, patterns, colors available, and method of installation.

D. Samples: Submit two samples 6 by 6 inch in size illustrating color and pattern for each carpet and cushion material specified.

E. Submit two, 4 inch long samples of edge strip for each color specified.

F. Maintenance Data: Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing specified carpet with minimum three years documented experience.

B. Installer Qualifications: Company specializing in installing carpet with minimum three years documented experience.

1.05 FIELD CONDITIONS

A. Store materials in area of installation for minimum period of 24 hours prior to installation.

B. Maintain minimum 70 degrees F ambient temperature 24 hours prior to, during and 24 hours after installation.

C. Ventilate installation area during installation and for 72 hours after installation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Carpet:
   1. Patcraft; www.patcraft.com Contact Manufacturer's Representative: Tom Conway 503-307-4592, tom.conway@patcraft.com..

B. Cushion:
   1. Modified-prime polyurethane foam.
      a. Density: 5.0 pounds per cubic foot minimum plus or minus 5 percent.
      b. Thickness: 7/16” at standard units; ¼” at accessible units.
      c. Green Label Certified.

2.02 CARPET

A. All new carpet shall bear the Carpet and Rug institute "Green Label" or shall be manufactured from at least 25% recycled materials.

B. All carpet must meet the acceptance criterion of Federal Standard DOCFF1-70 for flammability or Class II, 0.22 watts/cm2 per the International Building Code, whichever is greater.

C. All carpet must meet HUD UM-44D requirements.

D. Resident Unit carpet:
   1. OHFA compliant - Patcraft, Odyssey EPBL Voyage with EPBL backing

E. Contact Manufacturer's Representative: Tom Conway 503-307-4592, tom.conway@patcraft.com.

2.03 CUSHION

A. Cushion: OHFA compliant - closed cell, foam pad
   1. only used in non-HC resident units
   2. Leggett & Platt carpet cushion, Twilight
      a. Product code: BZ0235
      b. R-value: 1.64
      c. Thickness: 0.4375"
      d. FHA class: 1
      e. Roll size: 6'X45'
      f. inherent characteristics: antimicrobial, top and bottom moisture barrier, CRi Green Label Plus certified, meets or exceeds indoor air quality testing criteria

2.04 ACCESSORIES

A. Subfloor Filler: Type recommended by carpet manufacturer.

B. Tackless Strip: Carpet gripper, of type recommended by carpet manufacturer to suit application, with attachment devices.

C. Adhesives - General: Compatible with materials being adhered; maximum VOC content as specified in Section 01 6116.

D. Seam Adhesive: Recommended by manufacturer.

E. Contact Adhesive: Compatible with carpet material; releasable type.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that subfloor surfaces are smooth and flat within the tolerances specified for that type of work and are ready to receive carpet.

B. Verify that subfloor surfaces are dust-free and free of substances that could impair bonding of adhesives to subfloor surfaces.

C. Cementitious Subfloor Surfaces: Verify that substrates are ready for flooring installation by testing for moisture and alkalinity (pH).
   1. Obtain instructions if test results are not within limits recommended by flooring material manufacturer and adhesive materials manufacturer.

3.02 PREPARATION

A. Prepare floor substrates as recommended by flooring and adhesive manufacturers.

B. Remove subfloor ridges and bumps. Fill minor or local low spots, cracks, joints, holes, and other defects with subfloor filler.

C. Apply, trowel, and float filler to achieve smooth, flat, hard surface. Prohibit traffic until filler is cured.

D. Clean substrate.

3.03 INSTALLATION - GENERAL

A. Starting installation constitutes acceptance of subfloor conditions.

B. Install carpet and cushion in accordance with manufacturer's instructionsand CRI 104 (Commercial).

C. Verify carpet match before cutting to ensure minimal variation between dye lots.

D. Lay out carpet and locate seams in accordance with shop drawings.
   1. Locate seams in area of least traffic, out of areas of pivoting traffic, and parallel to main traffic.
   2. Do not locate seams perpendicular through door openings.
   3. Align run of pile in same direction as anticipated traffic and in same direction on adjacent pieces.
   4. Locate change of color or pattern between rooms under door centerline.
   5. Provide monolithic color, pattern, and texture match within any one area.

E. Install carpet tight and flat on subfloor, well fastened at edges, with a uniform appearance.

3.04 DIRECT-GLUED CARPET

A. Double cut carpet seams, with accurate pattern match. Make cuts straight, true, and unfrayed. Apply seam adhesive to cut edges of woven carpet immediately.

B. Apply contact adhesive to floor uniformly at rate recommended by manufacturer. After sufficient open time, press carpet into adhesive.

C. Apply seam adhesive to the base of the edge glued down. Lay adjoining piece with seam straight, not overlapped or peaked, and free of gaps.

D. Roll with appropriate roller for complete contact of adhesive to carpet backing.

E. Trim carpet neatly at walls and around interruptions.

3.05 CLEANING

A. Remove excess adhesive from floor and wall surfaces without damage.

B. Clean and vacuum carpet surfaces.

END OF SECTION

SECTION 09 90 00

PAINTING AND COATING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Surface preparation.

B. Field application of paints.

C. Scope: Finish all interior and exterior surfaces exposed to view, unless fully factory- finished and unless otherwise indicated.
   1. Walls, ceilings, base trim, casings, doors and frames.
   2. On roof where visible paint all pipes, ducts and chimneys that penatrate the roof to match roof color.
   3. Both sides and edges of plywood backboards for electrical and telecom equipment before installing equipment.
   4. Elevator pit ladders.
   5. Exposed surfaces of steel lintels and ledge angles.
   6. Prime surfaces to receive wall coverings.

D. Do Not Paint or Finish the Following Items:
   1. Items fully factory-finished unless specifically so indicated; materials and products having factory-applied primers are not considered factory finished.
   2. Items indicated to receive other finishes.
   3. Items indicated to remain unfinished.
   4. Fire rating labels, equipment serial number and capacity labels, and operating parts of equipment.
   5. Stainless steel, anodized aluminum, bronze, terne, and lead items.
   6. Marble, granite, slate, and other natural stones.
   7. Floors, unless specifically so indicated.
   8. Ceramic and other tiles.
   9. Glass.
   10. Acoustical materials, unless specifically so indicated.
   11. Concealed pipes, ducts, and conduits.

1.02 RELATED REQUIREMENTS

A. Section 01 3515 - LEED Certification Procedures: LEED rating system definition.

B. Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions.

1.03 DEFINITIONS

A. Conform to ASTM D16 for interpretation of terms used in this section.

1.04 REFERENCE STANDARDS

A. ASTM D16 - Standard Terminology for Paint, Related Coatings, Materials, and Applications 2014.

B. ASTM D4442 - Standard Test Methods for Direct Moisture Content Measurement of Wood and Wood-Base Materials 2007.

C. SSPC (PM1) - Good Painting Practice: SSPC Painting Manual, Vol. 1; Society for Protective Coatings; Fourth Edition.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide complete list of all products to be used, with the following information for each:
   1. Manufacturer's name, product name and/or catalog number, and general product category (e.g. "alkyd enamel").
   2. MPI product number (e.g. MPI #47).
   3. Cross-reference to specified paint system(s) product is to be used in; include description of each system.

C. Samples: Submit three paper "draw down" samples, 8-1/2 by 11 inches in size, illustrating range of colors available for each finishing product specified.
   1. Where sheen is specified, submit samples in only that sheen.

D. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 6000 - Product Requirements, for additional provisions.
   2. Extra Paint and Coatings: 1 gallon of each color.
   3. Label each container with color in addition to the manufacturer's label.
   4. Coating Maintenance Manual: Upon conclusion of the project, the Contractor or paint manufacturer/supplier shall furnish a coating maintenance manual, such as Sherwin-Williams “Custodian Project Color and Product Information” report . Manual shall include an Area Summary with finish schedule, Area Detail designating where each product/color/finish was used, product data pages, Material Safety Data Sheets, care and cleaning instructions, touch-up procedures, and color samples of each color and finish used.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified, with minimum three years documented experience.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.

B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.

C. Paint Materials: Store at minimum ambient temperature of 45 degrees F and a maximum of 90 degrees F, in ventilated area, and as required by manufacturer's instructions.

1.08 FIELD CONDITIONS

A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.

B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and

temperature limitations.

C. Do not apply exterior coatings during rain or snow, or when relative humidity is outside the humidity ranges required by the paint product manufacturer.

D. Minimum Application Temperatures for Latex Paints: 45 degrees F for interiors; 50 degrees F for exterior; unless required otherwise by manufacturer's instructions.

E. Minimum Application Temperature for Varnish Finishes: 65 degrees F for interior or exterior, unless required otherwise by manufacturer's instructions.

F. Provide lighting level of 80 ft candles measured mid-height at substrate surface.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Provide all paint and coating products used in any individual system from the same manufacturer; no exceptions.

B. Sherwin-Williams. NCR's standards for interior and exterior paint specifications are through Sherwin-Williams. The Promar 200 Zero VOC series of products are the core standard for interior painting. The A-100 series of products are the core standards for exterior painting. Please notify/contact Ryan Schneeman (NCR's National Account Representative) for NCR standards/spec and to register as a NCR construction project.

1. Contact information: Ryan M. Schneeman, National Strategic Account Manager, office 216-566-1765, cell 216-214-1606, ryan.schneeman@sherwin.com

C. Provide all paint and coating products from the same manufacturer to the greatest extent possible.

D. Paints:

1. Sherwin-Williams Company: www.sherwin-williams.com/#sle.

E. Transparent Finishes:

1. Sherwin-Williams Company: www.sherwin-williams.com/#sle.

F. Stains:

1. Sherwin-Williams Company: www.sherwin-williams.com/#sle.

G. Primer Sealers: Same manufacturer as top coats.

H. Block Fillers: Same manufacturer as top coats.

I. Substitutions: See Section 01 6000 - Product Requirements.

2.02 PAINTS AND COATINGS - GENERAL

A. Paints and Coatings: Ready mixed, unless intended to be a field-catalyzed coating.

1. Provide paints and coatings of a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.
2. Provide materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.
3. For opaque finishes, tint each coat including primer coat and

intermediate coats, one-half shade lighter than succeeding coat, with final finish coat as base color.

4. Supply each coating material in quantity required to complete entire project's work from a single production run.
5. Do not reduce, thin, or dilute coatings or add materials to coatings unless such procedure is specifically described in manufacturer's product instructions.

B. Primers: As follows unless other primer is required or recommended by manufacturer of top coats; where the manufacturer offers options on primers for a particular substrate, use primer categorized as "best" by the manufacturer.

C. Volatile Organic Compound (VOC) Content: Comply with Section 01 6116.

D. Sheens: Provide the sheens specified; where sheen is not specified, sheen will be selected later by Architect from the manufacturer's full line.

E. Colors: To be selected from manufacturer's full range of available colors.
1. Selection to be made by Architect after award of contract.
2. Allow for minimum of three colors for each system, unless otherwise indicated, without additional cost to Owner.
3. Extend colors to surface edges; colors may change at any edge as directed by Architect.

2.03 PAINT SYSTEMS - INTERIOR

A. CONCRETE - (Walls & Ceilings, Poured Concrete, Precast Concrete, Unglazed Brick,Cement Board, Tilt-Up, Cast-In-Place)

B. Latex Systems
1. Gloss
a. 1st Coat: S-W Loxon Concrete & Masonry Primer A24W8300 (7 mils wet, 3 mils dry)
b. 2nd Coat: S-W ProMar® 400 Latex Gloss B21W400 Series
c. 3rd Coat: S-W ProMar® 400 Latex Gloss B21W400 Series (4 mils wet, 1.5 mils dry per coat)

C. Concrete Stain (Water Base)
1. Flat Finish Opaque
a. 1st Coat: S-W H&C Concrete Stain Solid Color Water Based
b. 2nd Coat: S-W H&C Concrete Stain Solid Color Water Based (50-300 sq/ft per gallon)

D. CONCRETE- FLOORS
1. Acrylic System
a. Gloss Finish
1) 1st Coat: S-W Porch & Floor Enamel, A32-100 series
2) 2nd Coat: S-W Porch & Floor Enamel, A32-100 series (4 mils wet, 1.4 mils dry)
3) Alternate
4) 1st Coat: S-W Sher-Crete Flexible Concrete Waterproofer, A5 Series
5) 2nd Coat: S-W Sher-Crete Flexible Concrete Waterproofer, A5 Series (14-18 mils wet per coat)
2. Concrete Stain (Water Base)

a. Low Luster Finish Opaque
   1) 1st Coat: S-W H&C Concrete Stain Solid Color Water Based
   2) 2nd Coat: S-W H&C Concrete Stain Solid Color Water Based (50-300 sq/ft per gallon)

E. METAL - (Aluminum, Galvanized)
   1. Latex Systems
      a. Gloss Finish
         1) 1st Coat: S-W Pro Industrial Pro-Cryl® Primer, B66-310 Series (2-4 mils dry)
         2) 2nd Coat: S-W ProMar® 400 Latex Gloss Enamel, B21W400 Series
         3) 3rd Coat: S-W ProMar® 400 Latex Gloss Enamel, B21W400 Series (4 mils wet, 1.5 mils dry per coat)
      b. Semi-Gloss Finish
         1) 1st Coat: S-W Pro Industrial Pro-Cryl® Primer, B66-310 Series (2-4 mils dry)
         2) 2nd Coat: S-W ProMar 400 Zero VOC Latex Semi-Gloss B31W4600
         3) 3rd Coat: S-W ProMar 400 Zero VOC Latex Semi-Gloss B31W4600 (4 mils wet, 1.3 mils dry per coat)
      c. Block Resistant Finish
         1) 1st Coat: S-W Pro Industrial Pro-Cryl® Primer, B66-310 Series (2-4 mils dry)
         2) 2nd Coat: S-W ProClassic® Waterborne Acrylic Semi-Gloss Enamel, B31 Series
         3) 3rd Coat: S-W ProClassic® Waterborne Acrylic Semi-Gloss Enamel, B31 Series (4 mils wet, 1.3 mils dry per coat)
      d. Eg-Shel / Satin Finish
         1) 1st Coat: S-W Pro Industrial Pro-Cryl® Primer, B66-310 Series (2-4 mils dry)
         2) 2nd Coat: S-W ProMar 400 Zero VOC Latex Eg-Shel B20W4600
         3) 3rd Coat: S-W ProMar 400 Zero VOC Latex Eg-Shel B20W4600 (4 mils wet, 1.5 mils dry per coat)
      e. Flat Finish
         1) 1st Coat: S-W Pro Industrial Pro-Cryl® Primer, B66-310 Series (2-4 mils dry)
         2) 2nd Coat: S-W ProMar 400 Zero VOC Latex Flat B30W4600
         3) 3rd Coat: S-W ProMar 400 Zero VOC Latex Flat B30W4600 (4 mils wet, 1.4 mils dry per coat)
   2. Alkyd / Acrylic Systems
      a. Gloss Finish (Water base)
         1) 1st Coat: S-W Pro Industrial Pro-Cryl® Primer, B66-310 Series (2.0 - 4.0 mils dry per coat)
         2) 2nd Coat: S-W Waterbased Industrial Enamel, B53-300 Series
         3) 3rd Coat: S-W Waterbased Industrial Enamel, B53-300 Series (4 mils wet, 1.6 mils dry per coat)
      b. Semi-Gloss Acylic / Alkyd Finish
         1) 1st Coat: S-W Pro Industrial Pro-Cryl® Primer, B66-310 Series

(2-4 mils dry)
2) 2nd Coat: S-W -ProMar 200 Interior Waterbased Acrylic-Alkyd Semi- Gloss B34-8200
3) 3rd Coat: S-W ProMar 200 Interior Waterbased Acrylic-Alkyd Semi- Gloss B34-8200 (4 mils wet, 1.7 mils dry per coat)

F. WOOD- (Walls, Ceilings, Doors, Trim,)
1. Latex Systems
a. Gloss Finish
1) 1st Coat: S-W PrepRite® ProBlock Latex. B51 Series (4 mils wet, 1.4 mils dry)
2) 2nd Coat: S-W ProMar® 400 Latex Gloss, B21W400 Series
3) 3rd Coat: S-W ProMar® 400 Latex Gloss, B21W400 Series (4 mils wet,
1.5 mils dry per coat)
b. Semi-Gloss Finish
1) 1st Coat: S-W SW Multi-Purpose Interior / Exterior Latex Primer B51-450 Series (4 mils wet, 1.4 mils dry)
2) 2nd Coat: S-W ProMar 400 Zero VOC Latex Semi-Gloss B31W4600
3) 3rd Coat: S-W ProMar 400 Zero VOC Latex Semi-Gloss B31W4600 (4 mils wet, 1.3 mils dry per coat)
c. Eg-Shel / Satin Finish
1) 1st Coat: S-W SW Multi-Purpose Interior / Exterior Latex Primer B51-450 Series (4 mils wet, 1.4 mils dry)
2) 2nd Coat: S-W ProMar 400 Zero VOC Latex Eg-Shel B20W4600
3) 3rd Coat: S-W ProMar 400 Zero VOC Latex Eg-Shel B20W4600(4 mils wet, 1.5 mils dry per coat)
d. Flat Finish
1) 1st Coat: S-W SW Multi-Purpose Interior / Exterior Latex Primer B51-450 Series (4 mils wet, 1.4 mils dry)
2) 2nd Coat: S-W ProMar 400 Zero VOC Latex Flat B30W4600
3) 3rd Coat: S-W ProMar 400 Zero VOC Latex Flat B30W4600(4 mils wet, 1.4 mils dry per coat)
2. Alkyd Systems
a. Gloss Finish (Water base)
1) 1st Coat: S-W Premium Wall & Wood Primer B28W8111 (4 mils wet, 1.6 mils dry)
2) 2nd Coat: S-W Waterbased Industrial Enamel, B53-300 Series
3) 3rd Coat: S-W Waterbased Industrial Enamel, B53-300 Series (4 mils wet, 1.6 mils dry per coat)
b. Semi-Gloss (Solvent base) Finish
1) 1st Coat: S-W Premium Wall & Wood Primer B28W8111 (4 mils wet, 2 mils dry)
2) 2nd Coat: S-W ProMar 200 Interior Waterbased Acrylic-Alkyd Semi- Gloss B34-8200
3) 3rd Coat: S-W ProMar 200 Interior Waterbased Acrylic-Alkyd Semi- Gloss B34-8200(4 mils wet, 1.7 mils dry per coat)
3. At Wood Handrails:
a. 1st Coat: S-W SW Multi-Purpose Interior / Exterior Latex Primer

B51-450 Series (4 mils wet, 1.4 mils dry)

b. 2nd and 3rd Coat: S-W B65W181 Hydrogloss Single Component Water Base Urethane

G. DRYWALL (Walls, Ceilings, Gypsum Board, Plaster Board, etc.)

1. Latex Systems
   a. Gloss Finish
      1) 1st Coat: S-W ProMar 200 Zero VOC Interior Latex Primer B28W2600 (4 mils wet, 1.2 mils dry)
      2) 2nd Coat: S-W ProMar® 400 Latex Gloss, B21W400 Series
      3) 3rd Coat: S-W ProMar® 400 Latex Gloss, B21W400 Series (4 mils wet,
         1.5 mils dry per coat)
   b. Semi-Gloss Finish
      1) 1st Coat: S-W ProMar 200 Zero VOC Interior Latex Primer B28W2600 (4 mils wet, 1.2 mils dry)
      2) 2nd Coat: S-W ProMar 400 Zero VOC Latex Semi-Gloss B31W4600
      3) 3rd Coat: S-W ProMar 400 Zero VOC Latex Semi-Gloss B31W4600 (4 mils wet, 1.3 mils dry per coat)
   c. Eg-Shel / Satin Finish
      1) 1st Coat: S-W ProMar 200 Zero VOC Interior Latex Primer B28W2600 (4 mils wet, 1.2 mils dry)
      2) 2nd Coat: S-W ProMar 400 Zero VOC Latex Eg-Shel B20W4600
      3) 3rd Coat: S-W ProMar 400 Zero VOC Latex Eg-Shel B20W4600(4 mils wet, 1.6 mils dry per coat)
   d. Flat Finish
      1) 1st Coat: S-W ProMar 200 Zero VOC Interior Latex Primer B28W2600 (4 mils wet, 1.2 mils dry)
      2) 2nd Coat: S-W ProMar 400 Zero VOC Latex Flat B30W4600
      3) 3rd Coat: S-W ProMar 400 Zero VOC Latex Flat B30W4600 (4 mils wet, 1.4 mils dry per coat)
2. Alkyd Systems
   a. Semi- Gloss Finish (Solvent Base)
      1) 1st Coat: S-W ProMar 200 Zero VOC Interior Latex Primer B28W2600 (4 mils wet, 1.2 mils dry)
      2) 2nd Coat: S-W ProMar 200 Interior Waterbased Acrylic-Alkyd Semi- Gloss B34-8200
      3) 3rd Coat: S-W ProMar 200 Interior Waterbased Acrylic-Alkyd Semi- Gloss B34-8200(4 mils wet, 1.7 mils dry per coat)
   b. Eg-Shel / Satin Finish
      1) 1st Coat: S-W ProMar 200 Zero VOC Interior Latex Primer B28W2600 (4 mils wet, 1.2 mils dry)
      2) 2nd Coat: S-W ProMar 200 Interior Waterbased Acrylic-Alkyd Eg-Shel B33-8200
      3) 3rd Coat: S-W ProMar 200 Interior Waterbased Acrylic-Alkyd Eg-Shel B33-8200 (4 mils wet, 1.8 mils dry per coat)

2.04 ACCESSORY MATERIALS

A. Accessory Materials: Provide all primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials required to achieve the

finishes specified whether specifically indicated or not; commercial quality.

B. Patching Material: Latex filler.

C. Fastener Head Cover Material: Latex filler.

PART 3 EXECUTION

3.01 EXAMINATION

A. Do not begin application of coatings until substrates have been properly prepared.

B. Verify that surfaces are ready to receive work as instructed by the product manufacturer.

C. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application.

D. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

E. Test shop-applied primer for compatibility with subsequent cover materials.

F. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below the following maximums:
   1. Gypsum Wallboard: 12 percent.
   2. Masonry, Concrete, and Concrete Unit Masonry: 12 percent.
   3. Interior Wood: 15 percent, measured in accordance with ASTM D4442.
   4. Concrete Floors and Traffic Surfaces: 8 percent.

3.02 PREPARATION

A. Clean surfaces thoroughly and correct defects prior to coating application.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

C. Remove or repair existing coatings that exhibit surface defects.

D. Remove or mask surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces or finishing.

E. Seal surfaces that might cause bleed through or staining of topcoat.

F. Remove mildew from impervious surfaces by scrubbing with solution of tetra-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.

G. Concrete and Unit Masonry Surfaces to be Painted: Remove dirt, loose mortar, scale, salt or alkali powder, and other foreign matter. Remove oil and grease with a solution of tri-sodium phosphate; rinse well and allow to dry. Remove stains caused by weathering of corroding metals with a solution of sodium metasilicate after thoroughly wetting with water. Allow to dry.

H. Gypsum Board Surfaces to be Painted: Fill minor defects with filler compound. Spot prime defects after repair.

I. Galvanized Surfaces to be Painted: Remove surface contamination and oils and wash with solvent. Apply coat of etching primer.

J. Corroded Steel and Iron Surfaces to be Painted: Prepare using at least SSPC-SP 2 (hand tool cleaning) or SSPC-SP 3 (power tool cleaning)

followed by SSPC-SP 1 (solvent cleaning).

K. Uncorroded Uncoated Steel and Iron Surfaces to be Painted: Remove grease, mill scale, weld splatter, dirt, and rust. Where heavy coatings of scale are evident, remove by hand wire brushing or sandblasting; clean by washing with solvent. Apply a treatment of phosphoric acid solution, ensuring weld joints, bolts, and nuts are similarly cleaned. Prime paint entire surface; spot prime after repairs.

L. Shop-Primed Steel Surfaces to be Finish Painted: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces. Re-prime entire shop-primed item.

M. Interior Wood Surfaces to Receive Opaque Finish: Wipe off dust and grit prior to priming. Seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after primer has dried; sand between coats. Back prime concealed surfaces before installation.

3.03 APPLICATION

A. Apply products in accordance with manufacturer's instructions.

B. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.

C. Apply each coat to uniform appearance.

D. Dark Colors and Deep Clear Colors: Regardless of number of coats specified, apply as many coats as necessary for complete hide.

E. Sand wood surfaces lightly between coats to achieve required finish.

F. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.

G. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

3.04 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for general requirements for field inspection.

3.05 CLEANING

A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

3.06 PROTECTION

A. Protect finished coatings until completion of project.

B. Touch-up damaged coatings after Substantial Completion.

END OF SECTION

SECTION 10 14 00

SIGNAGE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Room and door signs.

B. Interior directional and informational signs.

C. Emergency evacuation maps.

D. Building identification signs.

1.02 REFERENCE STANDARDS

A. 36 CFR 1191 - Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines current edition.

B. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design 2010.

C. ICC A117.1 - Accessible and Usable Buildings and Facilities 2017.

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's printed product literature for each type of sign, indicating sign styles, font, foreground and background colors, locations, overall dimensions of each sign.

C. Signage Schedule: Provide information sufficient to completely define each sign for fabrication, including room number, room name, other text to be applied, sign and letter sizes, fonts, and colors.
   1. When room numbers to appear on signs differ from those on drawings, include the drawing room number on schedule.
   2. When content of signs is indicated to be determined later, request such information from Owner through Architect at least 2 months prior to start of fabrication; upon request, submit preliminary schedule.
   3. Submit for approval by Owner through Architect prior to fabrication.

D. Samples: Submit one sample, of size similar to that required for project, illustrating sign style, font, and method of attachment.

E. Selection Samples: Where colors are not specified, submit two sets of color selection charts or chips.

F. Manufacturer's Installation Instructions: Include installation templates and attachment devices.

G. Manufacturer's Qualification Statement.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Package signs as required to prevent damage before installation.

B. Package room and door signs in sequential order of installation, labeled by floor or building.

C. Store tape adhesive at normal room temperature.

1.06 FIELD CONDITIONS

A. Do not install tape adhesive when ambient temperature is lower than recommended by manufacturer.

B. Maintain this minimum temperature during and after installation of signs.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Flat Signs: Basis of design: NCR Interior Signs - Family A by Columbus Sign Co.. No substitutions allowed.

B. Other Signs - [_____]:

2.02 SIGNAGE APPLICATIONS

A. Verify sign list, quantity and exact verbiage with Owner through Architect with the submittal process prior to fabrication.

B. Accessibility Compliance: Signs are required to comply with ADA Standards and ICC A117.1 and applicable building codes, unless otherwise indicated; in the event of conflicting requirements, comply with the most comprehensive and specific requirements.
   1. All signs shall comply with ADA 703 Guidelines.
   2. Raised characters must be 48 inches minimum above the floor, measured to the baseline of the lowest raised character and 60 inches maximum above the floor, measured to the baseline of the highest raised character. ANSI 703.3.11.
   3. Grade 2 braille dots to comply with ADA Guideline 703.3
   4. Braille must be 48 inches minimum and 60 inches maximum above the foor, measured tothe baseline of the braille cell. ANSI 703.4.5.
   5. Comply with ADA section 703.1; regarding character dimensions, proportions and spacing
   6. Comply with section 703.5; finishes shall be non-glare and contrast with their background with either light characters on dark background of dark characters on a light background

C. At each door to an egress stairway, exit passageway and exit discharge, provide a tactile sign stating EXIT and complying with ICC A117.1. Provide sign adjacent to each door to an egress stairway, an exit passageway and the exit discharge.

D. At areas for assisted rescue, signage shall be provided as follows:
   1. Each door providing access to an area of refuge from an adjacent floor area shall be indentified be a sign complying with ICC A117.1, Section 1009.11 and OBC
      111.3 stating: AREA OF REFUGE, and including the International Symbol of Accessibility.
   2. Int he area of refuge and exterior areas for assisted rescue instruction on the use of the area under emergency conditions must be posted. Signage

must comply with ICC A117.1 requirments for visual characters. The instructions must include all of the following.

a. Persons ablve to use the exist stairway do so as soon as possible, unless they are assisting others.
b. Information on planned availability of assistance in the use of stairs or supervised operations of elevators and how to summon such assistance.
c. Directions for use of the two-way-communication system where provided.

E. Provide and post in a conspicuous place in each section and on each floor of the facility and emergency evacuation sign showing the floor plan indicating all exits and designating egress route from location of sign. Comply with requirements of local code officials.

F. Provide stairway floor number signs.

G. A sign shall be provided at each floor landing in interior vertical exit enclosures connecting fore than three stories designating the floor level, terminus of the top and bottom of the stair enclosure and the identification of the stair. The signage shall also state the story of, and the direction to the exit discharge and tha availabliity of roof access from theh stairway for the fire department. The sign shall be located 5 feet above the floor landing in a position which is readily visible when the doors are in the open and closed positions.

H. Room and Door Signs: Provide a sign for every doorway, whether it has a door or not, not including corridors, lobbies, and similar open areas.

1. URN - Unit Room Number Sign 3.5"X4"
2. SID - Stair Identification sign 9.5"X7.75"
3. ICF - In Cas of Fire sign 11"X7"
4. EM - Evacuation Map sign 11.5"X11"
5. SCID - Stair Core level ID sign 11.75"X10"
6. EX - Exit Sign 3.5"X4"
7. RSS - Typical room signs 3"X8"
8. RR - restroom signs 9.625"X8"
9. DWS - directional sign 10"X11"
10. IRD - insert room sign 11.5"X11"
11. Unit Doors: All unit door signage is to be noted with numerals only.
12. Office Doors: Identify with room names and numbers to be determined later, not those shown on the drawings; in addition, provide "window" section for replaceable occupant name.
13. Conference and Meeting Rooms: Identify with room names and numbers to be determined later, not those shown on the drawings; in addition, provide "window" section with sliding "In Use/Vacant" indicator.
14. Hot Room: provide "window" sedtion with sliding "In Use/Vacant" indicator.
15. Service Rooms: Identify with room names and numbers to be determined later, not those indicated on drawings.
16. Rest Rooms: Identify with pictograms, the names "MEN" and "WOMEN", and braille.
17. When signs are installed on glass provide matching panel to adhere to the backside. Panel to be same size and shape as room sign in color.

I. Laundry/Fitness: Provide signage that states USE AT YOUR OWN RISK.

J. Emergency Evacuation Maps:

K. Building Identification Signs:

2.03 ACCESSORIES

A. Tape Adhesive: Double sided tape, permanent adhesive.
   1. Applied to sign back by signage manufacturer
   2. Mounting surfaces to be fully cured per paint manufacturer's instructions, clean, smooth and free of debris.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrate surfaces are ready to receive work.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install neatly, with horizontal edges level.

C. Locate signs and mount at heights indicated on drawings and in accordance with ADA Standards and ICC A117.1.

D. Locate signs where indicated:
   1. Room and Door Signs: Locate on wall at latch side of door with centerline of sign at 60 inches above finished floor.

E. Protect from damage until Substantial Completion; repair or replace damaged items.

END OF SECTION

SECTION 10 26 00

WALL AND DOOR PROTECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Protective wall covering.

1.02 RELATED REQUIREMENTS

A. Section 09 2116 - Gypsum Board Assemblies: Placement of supports in stud wall construction.

1.03 REFERENCE STANDARDS

A. ASTM D256 - Standard Test Methods for Determining the Izod Pendulum Impact Resistance of Plastics 2010 (Reapproved 2018).

B. ASTM D543 - Standard Practices for Evaluating the Resistance of Plastics to Chemical Reagents 2020.

C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2020.

D. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials 2020.

E. ASTM F476 - Standard Test Methods for Security of Swinging Door Assemblies 2014.

F. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi 2015.

G. ICC A117.1 - Accessible and Usable Buildings and Facilities 2017.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Indicate physical dimensions, features, wall mounting brackets with mounted measurements, anchorage details, and rough-in measurements.

C. Shop Drawings: Include plans, elevation, sections, and attachment details. Show design and spacing of supports for protective corridor handrails, required to withstand structural loads.

D. Samples: Submit samples illustrating component design, configurations, joinery, color and finish.

1. Submit two samples of protective wall covering and door surface protection, 6 by 6 inches square.

E. Manufacturer's Instructions: Indicate special procedures, perimeter conditions requiring special attention.

F. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

G. Maintenance Materials: Furnish the following for Owner's use in

maintenance of project:
1. See Section 01 6000 - Product Requirements, for additional provisions.

H. Maintenance Data: Manufacturer's instructions for care and cleaning of each type of product. Include information about both recommended and potentially detrimental cleaning materials and methods.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver wall and door protection items in original, undamaged protective packaging. Label items to designate installation locations.

B. Protect work from moisture damage.

C. Protect work from UV light damage.

D. Do not deliver products to project site until areas for storage and installation are fully enclosed, and interior temperature and humidity are in compliance with manufacturer's recommendations for each type of item.

E. Store products in either horizontal or vertical position, in compliance with manufacturer's instructions.

1.06 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Correct defective Work within a one year period after Date of Substantial Completion.

C. Provide five year manufacturer and installer warranty for metal crash rails.
1. Failures include, but are not limited to, the following:
a. Structural failures, internal connection failures, and/or detachment of rail system from substrates.
b. Deterioration of materials beyond that expected of normal use, as intended by manufacturer.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Protective Wall Covering:
1. Construction Specialties, Inc; Acrovyn High-Impact Wall Covering: www.c- sgroup.com/#sle.
2. Inpro: www.inprocorp.com/#sle.
3. Marlite; www.marlite.com.

2.02 PERFORMANCE CRITERIA

A. Impact Strength: Unless otherwise noted, provide protection products and assemblies that have been successfully tested for compliance with applicable provisions of ASTM D256 and/or ASTM F476.

B. Chemical and Stain Resistance: Unless otherwise noted, provide protection products and assemblies with chemical and stain resistance complying with applicable provisions of ASTM D543.

C. Fungal Resistance: Unless otherwise noted, provide protection products and assemblies which pass ASTM G21 testing.

2.03 PRODUCT TYPES

A. Protective Wall Covering:

1. Thickness: 0.040 inch.
2. Surface Burning Characteristics: Provide assemblies with flame spread index of 25 or less and smoke developed index of 450 or less, when tested in accordance with ASTM E84.
3. Color: As selected from manufacturer's standard colors.
4. Accessories: Provide manufacturer's standard color-matched trim and moldings.
   a. Outside Corner Trim: Standard angle.
5. Mounting: Adhesive.

2.04 FABRICATION

A. Fabricate components with tight joints, corners and seams.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that rough openings, concealed blocking, and anchors are correctly sized and located.

B. Verify that field measurements are as indicated on drawings.

C. Verify that substrate surfaces for adhered items are clean and smooth.
   1. Test painted or wall covering surfaces for adhesion in inconspicuous area, as recommended by manufacturer. Follow adhesive manufacturer's recommendations for remedial measures at locations and/or application conditions where adhesion test's results are unsatisfactory.

D. Start of installation constitutes acceptance of project conditions.

3.02 INSTALLATION

A. Install components in accordance with manufacturer's instructions, level and plumb, secured rigidly in position to supporting construction.

B. Position protective wall covering no less than 1 inch above finished floor to allow for floor level variation.
   1. Apply adhesive with 1/8 inch V-notch trowel to an area of wall surface that can be completed within cure time of the adhesive.
   2. Install trim pieces as required for a complete installation. Allow tolerance for thermal movement.
   3. At joints indicated to be caulked, allow for a minimum 1/16 inch wide gap between edges of sheets. Gaps are required to be of consistent width throughout the project.

3.03 CLEANING

A. See Section 01 74 19 - Construction Waste Management and Disposal, for additional requirements.

B. Clean wall and door protection items of excess adhesive, dust, dirt, and other contaminants.

END OF SECTION

SECTION 10 28 00

TOILET, BATH, AND LAUNDRY ACCESSORIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Commercial toilet accessories.

B. Under-lavatory pipe supply covers.

C. Accessories for toilet rooms.

D. Grab bars.

1.02 RELATED REQUIREMENTS

A. Section 08 8300 - Mirrors: Other mirrors.

B. Section 09 3000 - Tiling: Ceramic washroom accessories.

1.03 REFERENCE STANDARDS

A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design 2010.

B. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products 2017.

C. ASTM A167 - Standard Specification for Stainless and Heat-Resisting Chromium- Nickel Steel Plate, Sheet, and Strip; 1999 (Reapproved 2009).

D. ASTM A269/A269M - Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service 2015a (Reapproved 2019).

E. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2020.

F. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar 2015.

G. ASTM B456 - Standard Specification for Electrodeposited Coatings of Copper Plus Nickel Plus Chromium and Nickel Plus Chromium 2017.

H. ASTM C1503 - Standard Specification for Silvered Flat Glass Mirror 2018.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordinate the work with the placement of internal wall reinforcement, concealed ceiling supports, and reinforcement of toilet partitions to receive anchor attachments.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Submit data on accessories describing size, finish, details of function, and attachment methods.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Commercial Toilet, Shower, and Bath Accessories:
   1. AJW Architectural Products; [___]: www.ajw.com/#sle.
   2. American Specialties, Inc; [___]: www.americanspecialties.com/#sle.
   3. Bradley Corporation; [___]: www.bradleycorp.com/#sle.
   4. Bobrick Corporation: www.bobrick.com/#sle..[___].

B. Residential Toilet, Shower, and Bath Accessories:
   1. Basis of Design: Franklin Brass - Kinley Series..[___].

2.02 MATERIALS

A. Accessories - General: Shop assembled, free of dents and scratches and packaged complete with anchors and fittings, steel anchor plates, adapters, and anchor components for installation.
   1. Grind welded joints smooth.
   2. Fabricate units made of metal sheet of seamless sheets, with flat surfaces.

B. Stainless Steel Sheet: ASTM A666, Type 304.

C. Stainless Steel Tubing: ASTM A269/A269M, Grade TP304 or TP316.

D. Galvanized Sheet Steel: Hot-dipped galvanized steel sheet, ASTM A653/A653M, with G90/Z275 coating.

E. Fasteners, Screws, and Bolts: Hot dip galvanized; tamper-proof; security type.

F. Expansion Shields: Fiber, lead, or rubber as recommended by accessory manufacturer for component and substrate.

2.03 FINISHES

A. Stainless Steel: Satin finish, unless otherwise noted.

B. Chrome/Nickel Plating: ASTM B456, SC 2, polished finish, unless otherwise noted.

2.04 COMMERCIAL TOILET ACCESSORIES

A. Living Units: (unless otherwise noted items listed are Franklin Brass Kinley Series)
   1. Medicine Cabinet: Broan 615.
   2. Towel Bars (not over 30” in length): KIN24-SN.
   3. Toilet paper Holder - KIN62-SN; KIN20-SN.
   4. Robe Hook - KIN35-SN.
   5. Shower Curtain rod - Franklin Brass 161-5.
   6. Grab bars - Franklin Brass 1 1/2" diameter (powder coated) with snap flanges (concealed fasteners).
      a. At retrofit conditions provide Franklin Brass grab bar anchor for non-stud mount #FB549.
   7. Shower Seats: Surface Mounted Retractable Shower Seat, 3/4" thick, one-piece high density white polymer.
      a. Built in shower seats: Reversible folding shower seat and frame; phenolic resin seat with 304 stainless steel brackets. Provide Franklin Brass 5181.
   8. Provide a weighted shower curtain in all roll in shower units. Provide "Premium Shower Curtain" by by Clarion Bathware; 16273 Rte 208; Marble PA 16334; Telephone: 814-782-3016.
   9. Mirror: 1/4” plate glass mirror with pencil edge; size per plans.

B. Public Bathrooms:
   1. Paper towel dispenser - AJ Washroom U2304-S2.
   2. Paper towel dispenser / waste receptacle - AJ Washroom U626
   3. Paper Holders - Franklin Brass Century 5508BSF
   4. Robe Hook - Franklin Brass Century 5502SF.
   5. Wall Mounted Soap Dispenser - Franklin Brass 1920, Satin.
   6. Grab bars - Franklin Brass 1 1/2" diameter (powder coated) with snap flanges (concealed fasteners).
   7. Mirror, ¼" plate glass - size per plans.

2.05 UNDER-LAVATORY PIPE AND SUPPLY COVERS

A. Under-Lavatory Pipe and Supply Covers:
   1. Insulate exposed drainage piping, including hot, cold, and tempered water supplies under lavatories or sinks to comply with ADA Standards.
   2. Exterior Surfaces: Smooth non-absorbent, non-abrasive surfaces.
   3. Color: White.

2.06 ATTIC STOCK

A. Supply the following as "attic stock" to the owner at the conclusion of the project:
   1. Two sets of bath accesories provided in apartments and one set ofbath accessories provided in the common arfea restrooms.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify exact location of accessories for installation.

C. Verify that field measurements are as indicated on drawings.

3.02 INSTALLATION

A. Install accessories in accordance with manufacturers' instructions in locations indicated on drawings.

B. Install plumb and level, securely and rigidly anchored to substrate.

C. Mounting Heights: As required by accessibility regulations, unless otherwise indicated.

D. Mounting Heights and Locations: As required by accessibility regulations, as indicated on drawings, and as follows:

3.03 PROTECTION

A. Protect installed accessories from damage due to subsequent construction operations.

END OF SECTION

SECTION 10 31 10

MANUFACTURED ELECTRIC FIREPLACES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Manufactured steel box fireplace.

1.02 REFERENCE STANDARDS

A. UL 127 - Standard for Factory-Built Fireplaces; Underwriters Laboratories Inc.; Current Edition, Including All Revisions.

1.03 SYSTEM DESCRIPTION

A. Built-in firebox electric faux flame, rectangular shape and remote control.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide fire box cabinet dimensions, clearances required from adjacent dissimilar construction, applicable regulatory agency approvals, electrical characteristics of fan.

C. Shop Drawings: Indicate fire box rough opening dimensions, rough opening sizes for chimney flue.

D. Manufacturer's Certificate: Certify that fireplace components meet or exceed UL requirements.

1.05 REGULATORY REQUIREMENTS

A. Conform to applicable code for clearances from adjacent materials, chimney height above roof line requirements, and unit UL approval.

B. Listed by Underwriters Laboratories Inc. as complying with UL 127.

C. Products Requiring Electrical Connection: Listed and labeled by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Manufactured Fireplaces:

1. Basis-of-Design Product: Electric ventless fireplace insert "Desa" hearth products. Model # VE 36LBHB .
    a. Or subject to compliance with requirements, provide a comparable product by one of the following:
        1) Heat & Glo[CHOICE TEXT]: www.heatnglo.com.
        2) Vermont Castings[CHOICE TEXT]: www.vermontcastings.com.
        3) Lennox Hearth Products[CHOICE TEXT]: www.lennoxhearthproducts.com.
        4) Substitutions: See Section 01 6000 - Product Requirements.

2.02 COMPONENTS

A. Fire Box: Formed insulated steel cabinet, rectangular shaped interior, configured to include chimney outlet and cleanout, refractory brick lining.

B. Exposed Cladding: Prepainted steel.

C. Fire Box Closure: Clear tempered glass doors in black steel frame, butt hinged, friction catch.

2.03 ACCESSORIES

A. Remote control.

B. Hardwired remote wall switch.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that prepared openings are ready to receive work and opening dimensions are as indicated on drawings.

B. Verify that proper power supply are available.

3.02 INSTALLATION

A. Install unit assembly in accordance with manufacturer's instructions and UL requirements.

END OF SECTION

SECTION 10 44 00

FIRE PROTECTION SPECIALTIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fire extinguishers.

B. Fire extinguisher cabinets.

C. Accessories.

1.02 RELATED REQUIREMENTS

A. Section 06 1000 - Rough Carpentry: Wood blocking product and execution requirements.

1.03 REFERENCE STANDARDS

A. NFPA 10 - Standard for Portable Fire Extinguishers 2017, with Errata (2018).

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate locations of cabinets and cabinet physical dimensions.

C. Product Data: Provide extinguisher operational features.

D. Manufacturer's Installation Instructions: Indicate special criteria and wall opening coordination requirements.

E. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

F. Maintenance Data: Include test, refill or recharge schedules and re-certification requirements.

1.05 FIELD CONDITIONS

A. Do not install extinguishers when ambient temperature may cause freezing of extinguisher ingredients.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Fire Extinguishers:
   1. Ansul, a Tyco Business; Cleanguard: www.ansul.com/#sle.
   2. Pyro-Chem, a Tyco Business; [____]: www.pyrochem.com/#sle.
   3. Strike First Corporation of America; ABC-Seamless Steel Fire Extinguisher: www.strikefirstusa.com/#sle.
   4. Substitutions: See Section 01 6000 - Product Requirements.

B. Fire Extinguisher Cabinets and Accessories:
   1. Ansul, a Tyco Business; [____]: www.ansul.com/#sle.
   2. JL Industries, Inc; [_____]: www.jlindustries.com.
   3. Larsen's Manufacturing Co; [____]: www.larsensmfg.com/#sle.
   4. Potter-Roemer; [_____]: www.potterroemer.com/#sle.
   5. Pyro-Chem, a Tyco Business; [____]: www.pyrochem.com/#sle.

2.02 FIRE EXTINGUISHERS

A. Fire Extinguishers - General: Comply with product requirements of NFPA 10 and applicable codes, whichever is more stringent.

B. Multipurpose Dry Chemical Type Fire Extinguishers: Carbon steel tank, with pressure gauge.
   1. Class: A:B:C type.
   2. Finish: Baked polyester powder coat red color.
   3. Temperature range: Minus 40 degrees F to [_____] degrees F.

2.03 KITCHEN FIRE EXTINGUISHERS

A. Wet Chemical Type Fire Extinguishers: Stainless steel tank, with pressure gauge.
   1. Class: K type.
   2. Size: 1.6 gallons.
   3. Finish: Polished stainless steel.
   4. Temperature range: Minus 20 degrees F to 120 degrees F.

2.04 FIRE EXTINGUISHER CABINETS

A. Metal: Formed primed steel sheet; 0.036 inch thick base metal.

B. Cabinet Configuration: Recessed type.
   1. Size to accommodate accessories.
   2. Trimless type.
   3. Provide cabinet enclosure with right angle inside corners and seams, and with formed perimeter trim and door stiles.

C. Door: 0.036 inch metal thickness, reinforced for flatness and rigidity with nylon catch. Hinge doors for 180 degree opening with two butt hinge.

D. Door Glazing: Acrylic plastic, clear, 1/8 inch thick, flat shape and set in resilient channel glazing gasket.

E. Cabinet Mounting Hardware: Appropriate to cabinet, with pre-drilled holes for placement of anchors.

F. Weld, fill, and grind components smooth.

G. Finish of Cabinet Exterior Trim and Door: No. 4 - Brushed stainless steel.

H. Finish of Cabinet Interior: White colored enamel.

2.05 ACCESSORIES

A. Extinguisher Brackets: Formed steel, chrome-plated.

B. Extinguisher Theft Alarm: Battery operated alarm, 10 second delay for disarming, activated by opening cabinet door.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify rough openings for cabinet are correctly sized and located.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install cabinets plumb and level in wall openings, [_____] inches from finished floor to inside bottom of cabinet.

C. Secure rigidly in place.
D. Place extinguishers in cabinets.

END OF SECTION

SECTION 10 55 00

POSTAL SPECIALTIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Central mail delivery boxes.

1.02 REFERENCE STANDARDS

A. 39 CFR 111 - U.S. Postal Service Standard 4C Current Edition.

B. 36 CFR 1191 - Americans with Disabilities Act Accessibility Guidelines for Buildings and Facilities; Final Rule; current edition; (ADA Standards for Accessible Design).

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's specifications and descriptive literature, installation instructions, maintenance information, and current USPS approval documentation.

C. Shop Drawings: Indicate plans for each unit or groups of units, front elevations with compartment layout and model number, overall dimensions, rough-in opening sizes, construction and anchorage details.

1.04 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Provide manufacturer's warranty against defects in materials or workmanship for a period of 5 years from Date of Substantial Completion.

PART 2 PRODUCTS

2.01 CENTRAL MAIL DELIVERY BOXES

A. Manufacturers:
   1. Florence Manufacturing Company: www.florencemailboxes.com/#sle.
   2. Jensen Mailboxes: www.jensenmailboxes.com/#sle.
   3. Postal Products Unlimited, Inc: www.postalproducts.com/#sle.
   4. Salsbury Industries: www.mailboxes.com/#sle.
   5. Security Manufacturing Corp: www.securitymanufacturing.com/#sle.
   6. Substitutions: See Section 01 6000 - Product Requirements.

B. Central Mail Delivery Boxes: Provide products approved for United States Postal Service (USPS) delivery.
   1. Materials: Aluminum with stainless steel hardware.
   2. Finish: Powder coat in color selected by Architect from manufacturer's standard colors.
   3. Unit Types and Sizes: As indicated on drawings.
   4. Configurations: See drawings for overall dimensions and layouts.

C. Wall-Mounted Mailboxes: Fully-recessed, complying with 39 CFR 111

(USPS- STD-4C).

1. [____]: Front-loading with master door, single-column design, with 1 outgoing mail compartment, 1 parcel compartment and one slot for Rent Checks. See drawings for configuration.
   a. Florence Manufacturing Compan[__].
   b. Jensen Mailboxes [___].
   c. Postal Products Unlimited, Inc [__].
   d. Salsbury Industriesl [___].
   e. Security Manufacturing Corp[__].

2.02 COMPONENTS

A. Locking - Front Loading Master Door: Three-point latching mechanism with USPS master lock furnished and installed by postmaster.

B. Locking - Customer Compartment Doors: USPS approved cam lock, 3 keys each lock.

C. Locking - Parcel Compartment Doors: Double-lock arrangement with USPS approved cam lock for customer access, and USPS master lock furnished and installed by postmaster.

D. Identification - Customer and Parcel Compartments: Sequential numerical or alphabetic characters, top to bottom, left to right; factory-installed.
   1. Engraved characters, 3/4 inch high, with black fill.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that rough-openings are ready to receive wall-mounted units.

B. Do not begin installation until unacceptable conditions are corrected.

3.02 INSTALLATION

A. Install postal specialties in accordance with approved shop drawings, manufacturer's instructions, and USPS requirements.

B. Adjust and lubricate door hardware to operate properly.

END OF SECTION

SECTION 10 57 23

CLOSET AND UTILITY SHELVING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Wall mounted wire closet shelving.

B. Accessories.

1.02 RELATED REQUIREMENTS

A. Section 06 1000 - Rough Carpentry: Blocking in walls for attachment of shelving.

B. Section 09 2116 - Gypsum Board Assemblies: Blocking in metal stud walls for attachment of standards.

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's data sheets on each product to be used, with installation instructions.

C. Shop Drawings: Provide drawings prepared specifically for this project; show dimensions of shelving and attachment to substrates.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

B. Store products under cover and elevated above grade.

C. Store flat to prevent warpage and bending.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Wire Storage Shelving:
   1. ClosetMaid Corporation : www.closetmaid.com/#sle.
   2. Schulte Corporation - ventilated
   3. Organized Living; freedomRail: www.organizedliving.com.
   4. RubberMaid Closet and Organization Products : www.rubbermaidcloset.com/#sle.
   5. Substitutions: See Section 01 6000 - Product Requirements.

2.02 SHELVING APPLICATIONS

A. Shelf Depth: 12 inches, unless otherwise indicated.

2.03 MATERIALS

A. Wire Shelving: Factory-assembled coated wire mesh shelf assemblies for

wall- mounting, with all components and connections required to produce a rigid structure that is free of buckling and warping.

1. Construction: Cold-drawn steel wire with average tensile strength of 100,000 psi resistance welded into uniform mesh units, square, rigid, flat, and free of dents or other distortions, with wires trimmed smooth.
2. Coating: PVC or epoxy, applied after fabrication, covering all surfaces.
3. PVC Coating: 9 to 11 mils thick.
4. Epoxy Coating: Non-toxic epoxy-polyester powder coating baked-on finish, 3 to 5 mils thick.
5. Standard Mesh Shelves: Cross deck wires spaced at 1 inch.

B. Hanging Rod: Tubular steel, 3/4" inch diameter, with end caps on open ends.
1. Finish: Epoxy powder coat.
2. Wall Thickness: 20 gage, 0.035 inch.
3. Provide corner hanging rods and hanging rod connectors where required.

C. Wall-Mounted Standards: Vertically slotted channel standards with double-tab cantilever brackets to suit shelving; factory finished to match shelving.

D. Mounting Hardware: Provide manufacturer's standard mounting hardware; include support braces, wall brackets, back clips, end clips, poles, and other accessories as required for complete and secure installation; factory finished to match shelving.
1. Provide intermediate support wall bracket for rod and shelf at any span 4' or more.

E. Fasteners: As recommended by manufacturer for mounting substrates.

PART 3 EXECUTION

3.01 EXAMINATION

A. Inspect areas to receive shelving, to verify that spaces are properly prepared to receive shelf units, and are of dimensions indicated on shop drawings.

B. Verify appropriate fastening hardware.

C. Do not begin installation until substrates have been properly prepared.

D. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.03 INSTALLATION

A. Install in accordance with manufacturer's instructions, with shelf surfaces level.

B. Cap exposed ends of cut wires.

C. Install back clips, end clips at side walls, and support braces at open ends. Install intermediate support braces as recommended by manufacturer but in no case exceeding 48" between supports.

D. Mounting Heights: See drawings.

3.04 CLEANING

A. Clean soiled surfaces after installation.

3.05 PROTECTION

A. Protect installed work from damage.

B. Touch-up, repair, or replace damaged products before Substantial Completion in a manner that eliminates evidence of replacement.

END OF SECTION

SECTION 10 75 00

FLAGPOLES

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 ground-mounted flagpoles made from aluminum.

B. Owner-Furnished Material: 5’ X 8’ Flag.

1.3 PERFORMANCE REQUIREMENTS

A. Structural Performance: Flagpole assemblies, including anchorages and supports, shall withstand the effects of gravity loads, and the following loads and stresses within limits and under conditions indicated according to the following design criteria:

1. Seismic Loads: according to SEI/ASCE 7.
2. Wind Loads: according to NAAMM FP 1001, "Guide Specifications for Design of Metal Flagpoles".
3. Base flagpole design on polyester flags of maximum standard size suitable for use with flagpole or flag size indicated, whichever is more stringent.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, operating characteristics, fittings, accessories, and finishes for flagpoles.

B. Qualification Data: For qualified professional engineer.

C. Operation and Maintenance Data: For flagpoles to include in operation and maintenance manuals.

1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain flagpole as complete unit, including fittings, accessories, bases, and anchorage devices, from single source from single manufacturer.

1.6 DELIVERY, STORAGE, AND HANDLING

A. General: Spiral wrap flagpoles with heavy paper and enclose in a hard fiber tube or other protective container.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

1. Admiral Flag Poles, Inc.
2. Baartol Company.
3. Morgan-Francis; Division of Original Tractor Cab Co., Inc.
4. U.S. Flag & Flagpole Supply, LP.

2.2 FLAGPOLES

A. Flagpole Construction, General: Construct flagpoles in one piece if possible. If more than one piece is necessary, comply with the following:

1. Fabricate shop and field joints without using fasteners, screw collars, or lead calking.
2. Provide flush hairline joints using self-aligning, snug-fitting, internal sleeves.
3. Provide self-aligning, snug-fitting joints.

B. Exposed Height: 30 feet.

C. Aluminum Flagpoles: Provide cone-tapered flagpoles fabricated from seamless extruded tubing complying with ASTM B 241/B 241M, Alloy 6063, with a minimum wall thickness of 3/16 inch.

D. Sleeve for Aluminum Flagpole: PVC pipe foundation sleeve, made to fit flagpole, for casting into concrete foundation.

1. Provide flashing collar of same material and finish as flagpole.

2.3 FITTINGS

A. Finial Ball: Manufacturer's standard beacon ball, sized as indicated or, if not indicated, to match flagpole-butt diameter.

1. Gold Anodized finish, to match existing flagpole finial ball.

A. Internal Halyard, Cam Cleat System: 5/16-inch diameter, braided polypropylene halyard; cam cleat; and concealed revolving truck assembly with plastic-coated counterweight and sling. Furnish flush access door secured with cylinder lock. Finish truck assembly to match flagpole.

B.

1. Halyard Flag Snaps: Provide two stainless-steel swivel snap hooks per halyard.

    a. Provide with neoprene or vinyl covers.

2. Plastic Halyard Flag Clips: Made from injection-molded, UV-stabilized, acetal resin (Delrin). Clips attach to flag and have two eyes for inserting both runs of halyards. Provide two flag clips per halyard.

    a. Product: Subject to compliance with requirements, provide "Quiet Halyard" flag clasp by Lingo

2.4 MISCELLANEOUS MATERIALS

A. Sand: ASTM C 33, fine aggregate.

B. Elastomeric Joint Sealant: Multicomponent nonsag urethane joint sealant complying with requirements in Division 07 Section "Joint Sealants" for Use NT (nontraffic) and for Use M, G, A, and, as applicable to joint substrates indicated, for Use O.

C. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

2.5 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, for compliance with requirements for installation tolerances, including foundation; accurate placement, pattern, orientation of anchor bolts, and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare uncoated metal flagpoles that are set in foundation tubes by painting below-grade portions with a heavy coat of bituminous paint.

B. Foundation Excavation: Excavate to neat clean lines in undisturbed soil. Remove loose soil and foreign matter from excavation and moisten earth before placing concrete. Place and compact drainage material at excavation bottom.

C. Provide forms where required due to unstable soil conditions and for perimeter of flagpole base at grade. Secure and brace forms to prevent displacement during concreting.

D. Place concrete, as specified in Division 03 Section "Cast-in-Place Concrete." Compact concrete in place by using vibrators. Moist-cure exposed concrete for not less than seven days or use nonstaining curing compound.

E. Trowel exposed concrete surfaces to a smooth, dense finish, free of trowel marks, and uniform in texture and appearance. Provide positive slope for water runoff to perimeter of concrete base.

3.3 FLAGPOLE INSTALLATION

A. General: Install flagpoles where shown and according to manufacturer's written instructions.

B. Ground Set: Place sleeve, center, and brace to prevent displacement during concreting. Place concrete. Plumb and level sleeve and allow concrete to cure. Install flagpole, plumb, in sleeve.

1. Foundation Tube: Place tube seated on bottom plate between steel centering wedges and install hardwood wedges to secure flagpole in place. Place and compact sand in foundation tube and remove hardwood wedges. Seal top of foundation tube with a 2-inch layer of elastomeric joint sealant and cover with flashing collar.

C. Baseplate: Cast anchor bolts in concrete foundation. Install baseplate on washers placed over leveling nuts on anchor bolts and adjust until flagpole is plumb. After flagpole is plumb, tighten retaining nuts and fill space under baseplate solidly with nonshrink, nonmetallic grout. Finish exposed grout surfaces smooth and slope 45 degrees away from edges of baseplate.

D. Mounting Brackets and Bases: Anchor brackets and bases securely through to structural support with fasteners as indicated on Shop Drawings.

END OF SECTION

SECTION 11 30 13

RESIDENTIAL APPLIANCES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Kitchen appliances.

1.02 RELATED REQUIREMENTS

A. Section 22 1005 - Plumbing Piping: Plumbing connections for appliances.

B. Section 26 0583 - Wiring Connections: Electrical connections for appliances.

1.03 REFERENCE STANDARDS

A. UL (DIR) - Online Certifications Directory Current Edition.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's data indicating dimensions, capacity, and operating features of each piece of residential equipment specified.

C. Copies of Warranties: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience.

B. Electric Appliances: Listed and labeled by UL (DIR) and complying with NEMA Standards (National Electrical Manufacturers Association).

C. Gas Appliances: Bearing design certification seal of American Gas Association (AGA).

D. The owner, National Church Residences has a national purchase contract with Whirpool Corporation. Contact the vendor representative to ensure national pricing is provided and product listings are correct: Kristi Griffeth, 865-470-5065; Kristi_1_Griffeth@whirlpool.com.

1.06 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Refrigerator: provide five (5) year manufacturer warranty on refrigerator compressor.

C. Refrigerator: provide 1 year manufacturer warranty on balance of refrigerator.

D. Rangehood: provide 1 year manufacturer warranty on rangehood.

E. Microwave Oven: provide 1 year manufacturer warranty.

F. Electric Range: 5 year limited manufacturer warranty on surface and 1 year manufacturer warranty on balance of appliance.

G. Dishwasher: provide 1 year manufacturer warranty

PART 2 PRODUCTS

2.01 KITCHEN APPLIANCES

A. All Equipment Eligible for Energy Star Rating shall be Energy Star Rated.

B. All ranges shall be provided with, and have installed an anti-tip bracket.

C. Apartment Units: Shall receive one each as follows: (color shall be black on stainless)
   1. Standard Unit Range: Whirlpool 30" Free-Standing Electric Range with Self-Cleaning Oven, Model #: WFE550S0HB
      a. Grease Shield: Baked on enamel finish over steel to match color of range or satin finished stainless steel with matching screws.
   2. Handicap Unit Range: Whirlpool 30" Slide-In Electric Range with Self-Cleaning Oven Model #: WEC310SAGB
      a. Grease Shield: Baked on enamel finish over steel to match color of range or satin finished stainless steel with matching screws. #99406
   3. Provide two (2) Stove Top brand “FireStop” (contractor to supply Owner with expiration dates per unit) automatic fire suppression canisters in each apartment, mounted on underside of range hood one over each side of range top.
   4. Range Hood: Whirlpool Range Hood Model #: UXT4030ADB, non-vented with charcoal filter and light.
   5. Unit Refrigerator all Units: "Whirlpool" Model No.: WRT134TFDB, energy star, 14 cubic foot, frost free. (ice maker deleted).
   6. Disposal: "Badger 1, 1/3 HP. Plug-in connection. Wire to wall switch.
   7. Dishwasher at standard units: “Whirlpool” Model#: WDF330PAHB, Energy Star, 24” built in.
   8. Dishwasher at HC units: Whirlpool Built-In Dishwasher; Model#: WDF550SAHB, Energy Star, 24” built in.

D. Public Kitchen shall receive the following:
   1. Whirlpool 25 cu. Ft. side by side refrigerator with dispenser, Estar Refrigerator in stainless steel model WRS325SDHZ
   2. Countertop Microwave, Whirlpool Model#: WMC30516HZ with manufacture's trim kit #MK2160AZ.
   3. Community Room Wall Oven: Whirlpool Model#: WOS51EC0HS
   4. Dishwasher: Whirlpool model no. WDF550SAHS.
   5. Disposal: "Badger 5XP, 3/4 HP. Plug-in connection. Wire to wall switch.

E. Exam Room shall receive the following:
   1. Undercounter refridgerator: Summit Appliance, Model#: FF7LSSHVADA

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify utility rough-ins are provided and correctly located.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

3.03 ADJUSTING

A. Adjust equipment to provide efficient operation.

3.04 CLEANING

A. Remove packing materials from equipment and properly discard.

B. Wash and clean equipment.

END OF SECTION

SECTION 11 82 50

WASTE CHUTES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Waste chutes and intake doors

1.02 REFERENCE STANDARDS

A. National Fire Protection Association(NFPA.82.1999), standards as referenced herein

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide unit capacities, physical dimensions, utility requirements and locations, point loads.

C. Shop Drawings: Indicate machine location, rough-in and anchor placement dimensions and tolerances, clearances required .

D. Shop Drawings:
   1. Plans: Scale 1/4 inch to 1 foot; indicate locations, dimensions, and required associated construction activities.
   2. Elevations/Sections: Scale 1/4 inch to 1 foot; indicate locations, dimensions, and required associated required construction activities.
   3. Details: Scale 1/4 inch to 1 foot; indicate:
      a. Shop drawings specific to project conditions
      b. Interface with adjacent construction
         1) Dimensions and tolerances
      c. Products required for installation of the trash chute, but not supplied by trash chute manufacturer.

E. Maintenance Data: Identify system maintenance requirements, servicing cycles, lubrication types required and local spare part sources.

F. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience.

1.05 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Manufacturer’s warranty: Furnish manufacturer’s standard one (1) year warranty from date of temporary certificate of occupancy or similar, locally mandated permission to use the project common areas for their intended use. Warranty shall apply to defects in product workmanship and materials.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Basis of Design: As indicated under product article below.

B. Waste Compactors:
   1. Marathon Equipment Co: www.marathonequipment.com.
   2. Wastequip, Inc: www.wastequip.com.
   3. Wilkinson-Hi-Rise LLC: www.whrise.com.
   4. Substitutions: See Section 01 6000 - Product Requirements.

2.02 MATERIALS

A. Components:
   1. The chute shall be 24” diameter of U.S. #16 gauge aluminized steel as manufactured by Wilkinson-Hi-Rise.
   2. Intakes Door: Stainless steel, 15 inches wide x 18 inches high, bottom hinged, hand operated self-closing positive latching doors bearing 1½ hour, Underwriters Laboratories “B” Label designation and rated for a 250° F maximum door temperature rise over 30 minutes, with stainless steel trim in a UL® approved, “B” Label, 1½ hour assembly.
   3. Discharge: Wilkinson, U.S. #16 gauge aluminized steel type “A” open end chute discharge rolling steel door with 165°F. fusible link hold open on an inclined steel track at the bottom of the chute to close automatically when the ambient temperature reaches 165°F. as required by city or state building and/or fire codes.
   4. Vent: Chute shall extend full diameter through roof to metal top vent cap
   5. 4’-0” above roof level with counter flashing and insect screen. A roof curb (44”x 44” x minimum of 8” high) is required for flat roof conditions and is to be provided by others.
   6. Accessories: 3/4 inch IPS flushing spray head and 1/2 inch sprinkler head above highest intake. Additional 1/2-inch sprinkler heads at every second intake (counting from the top) or as required by local code.
   7. Provide Disinfecting & Sanitizing unit for installation in line to the flushing spray head. Connection to flushing spray head, back flow prevention valve and electric control switch by others.
   8. Provide 15 inches wide x 15 inches high right side hinged, hand operated, self closing, positive latching, UL 1 1/2-hour. “B” labeled, stainless steel plumbing access door having stainless steel door trim for installation by forces erecting enclosing shaft wall. Door to have master keyed lock. Cylinder provided by others. Door for access to disinfecting & sanitizing unit above the highest intake door of the chute.
   9. Offsets (bends) in the chute, if required, shall be made the same diameter as the chute of #16 US gauge aluminized steel and have an additional layer of # 13 US gauge aluminized steel reinforcing the impact area. Offsets are not to deviate more than 15o off the vertical axis of the chute.
   10. Provide Daubert 932 sound coat vibration dampening compound to the exterior of the chute only. Include Korfund sound isolator pads at each floor support frame.
   11. Sprinkler System: Chute shall be protected internally by automatic sprinklers. This requires a sprinkler at or above the top intake door of the chute, and in addition, a sprinkler shall be installed within the chute at alternate floor levels in building over two stories in height with

mandatory sprinkler located at the lowest service level.

B. The trash chute shall be fully factory assembled and all joints, except those required to separate the sections for shipment and installation shall be welded or lock-seamed tight. The floor intake doors shall be bolted in place on throats formed into the chute. All chute sections shall flash inside the sections below and there shall be no bolts, clips, or other projections inside the chute to snag the flow of material. Pre-positioned support frames shall assure proper intake levels and there shall be an expansion joint in the chute between all support joints. Discharge hoppers and offsets, where required, shall be reinforced and separately supported in the impact area.

2.03 ACCESSORY ITEMS:

A. Provide two Rubbermaid carts model 1305-73 Recycling Tilt Truck.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verification of conditions:

1. Area in which system is to be located is correct size and location, and is prepared for installation of trash chute and components.

B. Installer’s examination:

1. Have installer of this section examine conditions under which construction activities of this section are to be performed, then submit written notification if conditions under which construction activities of this section are to be performed are unacceptable.
2. Beginning construction activities of this section before unacceptable conditions have been corrected is prohibited.
3. General Contractor shall verify and record chute alignment with installer immediately following installation.

3.02 INSTALLATION

A. Install trash chute in accordance with shop drawings and manufacturer’s printed installation instructions.

3.03 DEMONSTRATION

A. Arrange demonstration of system operation, conducted by manufacturer’s representative, to Owner’s maintenance personnel

3.04 INSTALLATION

A. Install unit and inlet hopper in accordance with manufacturer's instructions and with standards required by authority having jurisdiction.

B. Coordinate with waste chute discharge.

C. Anchor unit securely in place.

D. Touch-up minor damaged surfaces caused during installation. Replace damaged components as directed by Architect.

E. Adjust unit mechanism to achieve specified requirements.

3.05 CLOSEOUT ACTIVITIES

A. Demonstrate and instruct Owner on unit operation. Describe unit limitations.

END OF SECTION

SECTION 12 21 13

HORIZONTAL LOUVER BLINDS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Horizontal slat louver blinds.

B. Operating hardware.

1.02 RELATED REQUIREMENTS

A. Section 06 1000 - Rough Carpentry: Concealed wood blocking for attachment of headrail brackets.

1.03 REFERENCE STANDARDS

A. WCMA A100.1 - Safety of Window Covering Products 2018.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data indicating physical and dimensional characteristics.

C. Shop Drawings: Indicate opening sizes, tolerances required, method of attachment, clearances, and operation.

D. Manufacturer's Installation Instructions: Indicate special procedures.

E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. See Section 01 6000 - Product Requirements, for additional provisions.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Horizontal Louver Blinds Without Side Guides:

1. SWFcontract, a division of Spring Window Fashions, LLC: www.swfcontract.com/#sle.

2.02 BLINDS WITHOUT SIDE GUIDES

A. Description: Horizontal slat louvers hung from full-width headrail with full-width bottom rail.

B. Location: All living unit exterior windows. Including exterior doors with lites and side lites. All common area interior windows.

C. Manual Operation: Control of raising and lowering by cord with full range locking; blade angle adjustable by control wand.

D. Blinds: Horizontal slat louvers hung from full-width headrail with full-width bottom rail; manual control of raising and lowering by cord with full range locking; blade angle adjustable by control wand; complying with WCMA A100.1.

E. Plastic Slats: PVC foam, radiused slat corners.

1. Width: 1 inch.
2. Texture: Smooth.

F. Slat Support: Woven polypropylene cord, ladder configuration.

G. Head Rail: Pre-finished, formed aluminum box, with end caps; internally fitted with hardware, pulleys, and bearings for operation; same depth as width of slats.

H. Bottom Rail: Pre-finished, formed steel; with end caps.
   1. Color: Same as headrail.
   2. Location: doors with full lites or side lites i.e. patio doors. Confirm with architect.

I. Bottom Rail: Pre-finished, formed PVC with top side shaped to match slat curvature; with end caps. Color: Same as headrail.

J. Control Wand: Extruded hollow plastic; hexagonal shape.

K. Headrail Attachment: Wall brackets.

2.03 FABRICATION

A. Determine sizes by field measurement.

B. Fabricate blinds to fit within openings with uniform edge clearance of 1/4 inch.

C. Fabricate blinds to cover window frames completely.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that openings are ready to receive the work.

B. Ensure structural blocking and supports are correctly placed. See Section 06 1000.

3.02 INSTALLATION

A. Install window treatments in accordance with manufacturer's instructions.

B. Install window treatments level, plumb, square, and true. Allow proper clearances for window operation hardware.

C. Install the following items to conceal roller and operating mechanism. Do not use exposed fasteners.
   1. Fascias.
   2. Closure panels.
   3. Endcaps.

D. Secure in place with flush countersunk fasteners.

E. Place intermediate supports per manufacturer's instructions.

3.03 TOLERANCES

A. Maximum Variation of Gap at Window Opening Perimeter: 1/4 inch.

B. Maximum Offset From Level: 1/8 inch.

3.04 ADJUSTING

A. Adjust blinds for smooth operation.

3.05 CLEANING

A. Clean blind surfaces just prior to occupancy.

3.06 TESTING AND DEMONSTRATION

A. Demonstrate operation of shades to Owner's designated representatives.

END OF SECTION

SECTION 12 24 00

WINDOW SHADES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Window shades and accessories.

1.02 REFERENCE STANDARDS

A. NFPA 701 - Standard Methods of Fire Tests for Flame Propagation of Textiles and Films 2019.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Sequencing:
   1. Do not fabricate shades until field dimensions for each opening have been taken.
   2. Do not install shades until final surface finishes and painting are complete.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets including materials, finishes, fabrication details, dimensions, profiles, mounting requirements, and accessories.

C. Shop Drawings: Include shade schedule indicating size, location and keys to details.

D. Selection Samples: Include fabric samples in full range of available colors and patterns.

E. Warranty: Submit sample of manufacturer's warranty and documentation of final executed warranty completed in Owner's name and registered with manufacturer.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing work of this type with minimum 3 years of documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver shades in manufacturer's unopened packaging, labeled to identify each shade for each opening.

B. Handle and store shades in accordance with manufacturer's recommendations.

1.07 FIELD CONDITIONS

A. Do not install products under environmental conditions outside manufacturer's absolute limits.

1.08 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Provide manufacturer's warranty from Date of Substantial Completion,

covering the following:
1. Shade Hardware: One year.
2. Fabric: One year.
3. Aluminum and Steel Coatings: One year.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Interior Manually Operated Roller Shades:
   1. Draper, Inc; Clutch Operated FlexShade: www.draperinc.com/#sle.

B. Shade Fabric:
   1. Sheerweave 5% open.

2.02 WINDOW SHADE APPLICATIONS

A. Shadesat common area exterior and interior windows: Sheer shades.
   1. Type: Roller shades.
   2. Location: Common area exterior windows. Common area interior windows. Common area doors with lites and side lites.
   3. Mounting: Inside (between jambs).
   4. Operation: Manual.

2.03 ROLLER SHADES

A. Roller Shades: Fabric roller shades complete with mounting brackets, roller tubes, hembars, hardware and accessories.
   1. Size: As indicated on drawings.

B. Fabric: Non-flammable, color-fast, impervious to heat and moisture, and able to retain its shape under normal operation.
   1. Sheer Shades: Reduce glare yet still reveal considerable details to the outside; no privacy; Openness Factor greater than 1 percent.
   2. Flammability: Pass NFPA 701 large and small tests.

C. Roller Tubes: As required for type of operation.

D. Hembars: Designed for weight requirements and adaptation to uneven surfaces, to maintain bottom of shade straight and flat.

E. Manual Operation for Interior Shades: Clutch operated continuous loop; beaded ball chain.

2.04 ACCESSORIES

A. Fascias: Size as required to conceal shade mounting.
   1. Style: As selected by Architect from shade manufacturer’s full selection.

B. Brackets and Mounting Hardware: As recommended by manufacturer for mounting configuration and span indicated.

C. Fasteners: Non-corrosive, and as recommended by shade manufacturer.

2.05 FABRICATION

A. Fabricate shades to fit openings within specified tolerances.
   1. Vertical Dimensions: Fill openings from head to sill with 1/2 inch space between bottom bar and window sill.
   2. Horizontal Dimensions - Inside Mounting: Fill openings from jamb to jamb.

B. Dimensional Tolerances: As recommended in writing by manufacturer.

C. At openings requiring continuous multiple shade units with separate rollers, locate roller joints at window mullion centers; butt rollers end-to-end.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine finished openings for deficiencies that may preclude satisfactory installation.

B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

C. Start of installation shall be considered acceptance of substrates.

3.02 PREPARATION

A. Prepare surfaces using methods recommended by manufacturer for achieving best result for substrate under the project conditions.

B. Coordinate with window installation and placement of concealed blocking to support shades.

3.03 INSTALLATION

A. Install in accordance with manufacturer's instructions and approved shop drawings, using mounting devices as indicated.

B. Installation Tolerances:
   1. Inside Mounting: Maximum space between shade and jamb when closed of 1/16 inch.
   2. Maximum Offset From Level: 1/16 inch.

C. Adjust level, projection and shade centering from mounting bracket. Verify there is no telescoping of shade fabric. Ensure smooth shade operation.

3.04 CLEANING

A. Clean soiled shades and exposed components as recommended by manufacturer.

B. Replace shades that cannot be cleaned to "like new" condition.

3.05 CLOSEOUT ACTIVITIES

A. Demonstration: Demonstrate operation and maintenance of window shade system to Owner's personnel.

3.06 PROTECTION

A. Protect installed products from subsequent construction operations.

B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION

SECTION 12 35 30

RESIDENTIAL CASEWORK

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Kitchen cabinets.

B. Vanity cabinets.

C. Casework hardware.

1.02 RELATED REQUIREMENTS

A. Section 12 3600 - Countertops.

1.03 REFERENCE STANDARDS

A. BHMA A156.9 - American National Standard for Cabinet Hardware 2015.

B. HPVA HP-1 - American National Standard for Hardwood and Decorative Plywood 2016.

C. KCMA A161.1 - Performance and Construction Standard for Kitchen and Vanity Cabinets 2017.

D. NEMA LD 3 - High-Pressure Decorative Laminates 2005.

E. KCMA (DIR) - Directory of Certified Cabinet Manufacturers Current Edition.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide component dimensions, configurations, construction details, and joint details.

C. Shop Drawings: Indicate casework locations, elevations, clearances required, rough-in and anchor placement dimensions and tolerances.

D. Cabinet Finish Sample: Submit two samples of each type of finish, 2 inches by 3 inches in size, illustrating color, texture, gloss, and wood species.

E. Manufacturer's Qualification Statement.

1.05 QUALITY ASSURANCE

A. Products: Complying with KCMA A161.1 and KCMA Certified.

B. Manufacturer: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

1.06 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Correct defective Work within a five year period after Date of Substantial Completion.

C. Provide five year manufacturer warranty.

PART 2 PRODUCTS

2.01 CABINETS

A. Manufacturers:
   1. Substitutions: See Section 01 6000 - Product Requirements.

B. Kitchen and Vanity Cabinets: Premanufactured and factory-finished, complying with construction and testing requirements in KCMA A161.1.

C. Cabinet Box: Framed construction.
   1. Side Panels: Plywood.
   2. Face Frame: Solid wood.
   3. Interior Cabinet Finish: Thermally fused laminate.
      a. Color: to be selected by Architect...

D. Cabinet Door/Drawer Configuration: Partial overlay.

E. Cabinet Doors:
   1. Style: Brighton manufactured by SMART Cabinetry.
   2. Species: Maple.
   3. Color/Pattern: As indicated on the drawings.

F. Cabinet Hardware: As selected from manufacturer's standard types, styles and finishes.
   1. Comply with BHMA A156.9.
   2. Drawer and Cabinet Pulls: Amerock Allison.
   3. Drawer and Cabinet Knobs: Amerock Allison.
   4. Hinges: Manufacturer's standard self-closing concealed hinges.
   5. Drawer Slides: Manufacturer's standard self-closing drawer slides.

G. Countertops: As specified in Section 12 3600.

2.02 MATERIALS

A. Adhesives Used for Assembly: Comply with VOC requirements for adhesives and sealants as specified in Section 01 6116.

B. Wood-Based Materials:
   1. Certified as sustainably harvested as specified in Section 01 6000.
   2. Solid Wood: Air-dried to 4.5 percent moisture content, then tempered to 6 percent moisture content before use.

C. Solid Wood: Clear, dry, sound, plain sawn, selected for species grain and color, no defects.

D. Hardwood Plywood: Veneer core; HPVA HP-1 Grade as indicated; same species as exposed solid wood, clear, compatible grain and color, no defects. Band exposed edges with solid wood of same species as veneer.

E. Thermally Fused Laminate (TFL): Melamine resin, NEMA LD 3, Type VGL laminate panels.

2.03 MANUFACTURERS

A. Residential Casework: Basis of design manufacturers listed below:
   1. Living Units: Smart Cabinetry, Brighton Maple; finish as selected.
   2. Common Areas: Smart Cabinetry, Brighton Maple; finish as selected.

2.04 COMPONENTS

A. Cabinet Construction: Softwood lumber framing and particle board, tempered hardboard gables.

B. Kitchen Countertop: Post formed plastic laminate over particle board, coved to back splash.

C. Vanity Countertop: Post formed plastic laminate over particle board, coved to back splash.

D. Door and Drawer Fronts: Solid wood.

E. Bolts, Nuts, Washers and Screws: Of size and type to suit application.

F. Concealed Joint Fasteners: Threaded steel.

2.05 HARDWARE

A. Hardware: BHMA A156.9, types as recommended by fabricator for quality grade specified.

B. Adjustable Shelf Supports: Standard side/ back-mounted system using 1 inch spacing adjustments.

C. Drawer and Door Pulls:
   1. Product: Allison Value 3 inch(76mm) CTC pull; satin nickel. part no. BP69153G10 manufactured by Amercok.

D. Cabinet Locks: Keyed cylinder, two keys per lock, master keyed, steel with chrome finish. At all common area cabinets.

E. Drawer Slides:
   1. Type: Full extension.
   2. Static Load Capacity: Commercial grade.
   3. Mounting: Side mounted.
   4. Stops: Integral type.

F. Hinges: European style concealed self-closing type, steel with satin finish.

G. Pull out shelf: provide one manufactures pull out shelf in one base cabinet per dwelling unit.

2.06 FABRICATION

A. Shop assemble casework for delivery to site in units easily handled and to permit passage through building openings.

B. Fabricate corners and joints without gaps.

C. Form smooth edges. Form material for countertops, shelves, and drain boards from continuous sheets.

D. Provide cutouts for plumbing fixtures and appliances. Prime paint contact surfaces of cut edges.

E. When necessary to cut and fit on site, provide materials with ample allowance for cutting. Provide trim for scribing and site cutting.

2.07 FINISHES

A. Interior Surfaces: Plastic Laminate of manufacturer's standard color.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify adequacy of support framing.

3.02 INSTALLATION

A. Install casework, components and accessories in accordance with

manufacturer's instructions.

B. Use anchoring devices to suit conditions and substrate materials encountered.

C. Set casework items plumb and square, securely anchored to building structure.

D. Carefully scribe casework abutting other components, with maximum gaps of [__] inch.

E. Close ends of units, back splashes, shelves and bases.

3.03 ADJUSTING

A. Adjust doors, drawers, hardware, and other moving or operating parts to function smoothly.

3.04 CLEANING

A. Clean casework, countertops, shelves, and hardware.

3.05 PROTECTION

A. Do not permit finished casework to be exposed to continued construction activity.

END OF SECTION

SECTION 12 36 00

COUNTERTOPS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Countertops for architectural cabinet work.

B. Countertops for manufactured casework.

C. Wall-hung counters and vanity tops.

1.02 RELATED REQUIREMENTS

A. Section 12 3530 - Residential Casework.

B. Section 22 4000 - Plumbing Fixtures: Sinks.

1.03 REFERENCE STANDARDS

A. ANSI A161.2 - Performance Standards for Fabricated High Pressure Decorative Laminate Countertops; 1998.

B. ANSI A208.1 - American National Standard for Particleboard 2016.

C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2020.

D. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards 2014, with Errata (2018).

E. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards, U.S. Version 3.1 2017, with Errata (2019).

F. NEMA LD 3 - High-Pressure Decorative Laminates 2005.

G. PS 1 - Structural Plywood 2009.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's data sheets on each product to be used, including:
   1. Preparation instructions and recommendations.
   2. Storage and handling requirements and recommendations.
   3. Specimen warranty.

C. Shop Drawings: Complete details of materials and installation ; combine with shop drawings of cabinets and casework specified in other sections.

D. Selection Samples: For each finish product specified, color chips representing manufacturer's full range of available colors and patterns.

1.05 QUALITY ASSURANCE

A. Fabricator Qualifications: Same fabricator as for cabinets on which tops are to be installed.

B. Installer Qualifications: Fabricator.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

B. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.07 FIELD CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

PART 2 PRODUCTS

2.01 COUNTERTOPS

A. Quality Standard: Custom Grade, in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), unless noted otherwise.

B. Plastic Laminate Countertops: High-pressure decorative laminate (HPDL) sheet bonded to substrate.
   1. Laminate Sheet: NEMA LD 3, Grade HGS.
      a. Manufacturers:
         1) Formica Corporation: www.formica.com/#sle.
         2) Wilsonart: www.wilsonart.com/#sle.
      b. Surface Burning Characteristics: Flame spread index of 25, maximum; smoke developed index of 450, maximum; when tested in accordance with ASTM E84.
      c. NSF approved for food contact.
      d. Finish: Matte or suede, gloss rating of 5 to 20.
      e. Surface Color and Pattern: As selected by Architect from the manufacturer's full line.
      f. Manufacturers:
         1) Formica Corporation: www.formica.com.
         2) Wilsonart, LLC: www.wilsonart.com.
   2. Provide rounded outside corners.
   3. Exposed Edge Treatment: Square, substrate built up to minimum 1-1/4 inch thick; covered with matching laminate.
   4. Back and End Splashes: Same material, same construction;
   5. Fabricate in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), Section 11 - Countertops, Custom Grade.
   6. Fabricate in accordance with AWI/AWMAC/WI (AWS), Section 11 - Countertops, Custom Grade.
   7. Underside of countertops: Seal with low VOC sealant.

C. Natural Stone Countertops: Stone slabs bonded to substrate; use as large pieces as possible with inconspicuous adhesive joints.
   1. Stone: Granite without cracks, voids, or pin holes ; filling with matching epoxy resin is acceptable.
   2. Color: Giallo Ornamental White.
   3. Stone Thickness: 1 inch, minimum.
   4. Surface Finish: Polished.
   5. Exposed Edge Treatment: Square profile stone, 1 inch thick, with 1/2 inch radius corner.
   6. Back and End Splashes: Same material, same thickness; for field attachment.

7. See drawings.

2.02 MATERIALS

A. Wood-Based Components:
   1. Wood fabricated from old growth timber is not permitted.

B. Plywood for Supporting Substrate: PS 1 Exterior Grade, A-C veneer grade, minimum 5-ply; minimum 3/4 inch thick; join lengths using metal splines.

C. Particleboard for Supporting Substrate: ANSI A208.1 Grade 2-M-2, 45 pcf minimum density; minimum 3/4 inch thick; join lengths using metal splines.

D. Adhesives: Chemical resistant waterproof adhesive as recommended by manufacturer of materials being joined.

E. Joint Sealant: Mildew-resistant silicone sealant, color as selected by Architect clear.

2.03 FABRICATION

A. Fabricate tops and splashes in the largest sections practicable, with top surface of joints flush.
   1. Join lengths of tops using best method recommended by manufacturer.
   2. Fabricate to overhang fronts and ends of cabinets 1 inch except where top butts against cabinet or wall.
   3. Prepare all cutouts accurately to size; replace tops having improperly dimensioned or unnecessary cutouts or fixture holes.
   4. Provide radiused outside corners.

B. Provide back/end splash wherever counter edge abuts vertical surface unless otherwise indicated.
   1. Secure to countertop with concealed fasteners and with contact surfaces set in waterproof glue.
   2. Height: 4 inches standard. Provide 6" height at accessible units and public use common areas unless otherwise indicated.

C. Wall-Mounted Counters: Provide skirts, aprons, brackets, and braces as indicated on drawings, finished to match.

PART 3 EXECUTION

3.01 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. Field Measurements: Verify countertop size and shape prior to fabrication by field measurements taken after base units are installed.

C. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

D. Verify that wall surfaces have been finished and mechanical and electrical services and outlets are installed in proper locations.

3.02 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.03 INSTALLATION

A. Securely attach countertops to cabinets using concealed fasteners. Make flat surfaces level; shim where required.

B. Attach plastic laminate countertops using screws with minimum penetration into substrate board of 5/8 inch.

C. Attach wood countertops using screws with minimum penetration into substrate board of 5/8 inch.

D. Seal joint between back/end splashes and vertical surfaces.

3.04 TOLERANCES

A. Variation From Horizontal: 1/8 inch in 10 feet, maximum.

B. Offset From Wall, Countertops: 1/8 inch maximum; 1/16 inch minimum.

C. Field Joints: 1/8 inch wide, maximum.

3.05 CLEANING

A. Clean countertops surfaces thoroughly.

3.06 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Date of Substantial Completion.

END OF SECTION

SECTION 12 48 13

ENTRANCE FLOOR MATS AND FRAMES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Carpet mat.

1.02 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Samples: Submit two samples, [_____] by [__] inch in size illustrating pattern, color, finish, and edging.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Floor Mats:

1. American Floor Products Company, Inc; [___]: www.afco-usa.com/#sle.
2. R.C. Musson Rubber Co; [____]: www.mussonrubber.com/#sle.
3. Pawling Corporation; [____]: www.pawling.com/#sle.

2.02 MATS

A. Carpet Mat: Cut nylon pile permanently bonded to vinyl backing; [____] inch wide by [_____] inch long with one inch black matching vinyl border on all edges.

PART 3 EXECUTION

3.01 PREPARATION

A. Mats: Verify size of floor recess before fabricating mats.

B. Vacuum clean floor recess.

3.02 INSTALLATION

A. Install walk-off surface in floor recess flush with finish floor after cleaning of finish flooring.

END OF SECTION

SECTION 12 93 15

SITE FURNISHINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Site Furnishings

1.02 RELATED REQUIREMENTS

A. Section 03 3000 - Cast-in-Place Concrete: Mounting surface for bicycle racks.

B. Section 05 5000 - Metal Fabrications: Custom metal outdoor furnishings.

1.03 REFERENCE STANDARDS

A. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2008.

B. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc- Coated, Welded and Seamless; 2012.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's data sheets on each product to be used, including:
   1. Preparation instructions and recommendations.
   2. Storage and handling requirements and recommendations.
   3. Installation methods.

C. Selection Samples: For each finish product specified, color chips representing manufacturer's full range of available colors and patterns.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

B. Handle furnishings with sufficient care to prevent scratches and other damage to the finish.

PART 2 PRODUCTS

2.01 BENCHES

A. Heavy-duty public space seating constructed of the following components.
   1. Product Style - Landscape Forms, Inc.; “Petoskey” Backed polysite quad support Bench, surface mounted Site and Street Furniture Seating Model Number LFK3178SM . Landscape Forms - (800) 624-2443.
   2. Support: Tubular steel 3” o.d., 0.120-inch wall thickness.
   3. Seating Panels:Landscape Forms, Inc. PolySite 100% high-density polyethylene (HDPE) derived from recycled post-consumer packaging with over 90% recycled content by weight. PolySite timbers extruded to 2” x 6” nominal Fay 2006-08 Modernization Site Furnishings
      a. molded face boards and 2”x3” interior boards. All boards shall have eased edges as well as ends. Each board mounted with tamper-resistant screws onto heavy gauge steel backstraps.
   4. System Size: 26” deep x 32” high x 78” long - nominal.
   5. Steel Finishes - Rust inhibitor and topcoat finish of thermosetting

polyester powder coat that is U.V., chip and flake resistant - Landscape Forms Pangard II. All surfaces shall receive this coating.

6. Color - as selected by Architect.
7. Graffiti Guard - Landscape Forms Graffiti Guard coating. Field applied to steel per manufacturer's instructions.
8. Mounting - Surface mounted into thickened concrete.
9. Warranty - 3-year manufacturer's warranty.

2.02 INDOOR BICYCLE RACKS:

A. Bike Security Racks Co., Inc.: www.bikeracks.com.

B. Creative Pipe, Inc : www.creativepipe.com.

C. Highland Products Group, LLC : www.indoorbikeracks.net.

D. Substitutions: See Section 01 6000 - Product Requirements.

2.03 BICYCLE RACKS

A. Interior Bicycle Racks: Device designed for indoor storage of bicycles; allows user provided lock to simultaneously secure one wheel and part of the frame on each bicycle parked or racked.
   1. Capacity:tbdbicycles.

B. Materials:

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine surfaces to receive site furnishings.

B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

C. Do not begin installation until unsatisfactory substrates have been properly repaired.

3.02 PREPARATION

A. Ensure surfaces to receive furnishings are clean, flat, and level.

3.03 INSTALLATION

A. Site Preparation: Provide and construct concrete base as indicated.
   1. Subgrades: Level soil to accommodate new 5" concrete slab. Compact soil.
   2. Concrete:4,000 psi air-entrained concrete with fiber mesh. Smooth wood steel trowl finish.

B. Installation of Benches:Where indicated on the drawings provide and install the bench in accordance with manufacturers instructions for an embedded installation. Provide ½" x 10" J-bolts. Set J-bolts into 12"dia. x 24" deep concrete footing. At concrete pads bolt in place to concrete pad without footing. Place top of footing flush with surrounding grade and so that the bench will be installed level and plumb. Assemble bench in accordance with manufacturer's printed instructions.E. Installation of Picnic Table:Where indicated on the drawings provide and place the picnic table in accordance with manufacturers instructions. Provide ½" x 10" J-bolts. Set J-bolts into 12"dia. x 24" deep concrete footing. At concrete pads bolt in place to concrete pad without footing. Place top of footing flush with surrounding grade and so that the bench will be installed level and plumb. Assemble bench in accordance with manufacturer's printed instructions.

C. Restore adjacent areas or otherwise disturbed areas after finish grading and before planting.

D. Install in accordance with manufacturer's instructions.

E. Install bicycle racks level, plumb, square, and correctly located as indicated on the drawings.

F. In-Ground Anchor Installation:
   1. Prepare holes in size according to manufacturer’s instructions.
   2. Place anchoring bolts through the holes in the pipe.
   3. Lower rack into holes, ensuring the bottom of lower bends are at least 1-1/2 inch from the ground.
   4. Pour concrete and level rack.
   5. Support until dry.

G. Surface Flange Installation: Anchor furnishings securely in place with 1/2 inch by 4 inch anchor bolts through flange holes.

3.04 CLEANING

A. Clean installed work to like-new condition. Do not use cleaning materials or methods that could damage finish.

3.05 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION

SECTION 14 24 23

HYDRAULIC PASSENGER ELEVATORS

PART 1 GENERAL

1.01 WORK INCLUDED

A. Provide all labor, materials, equipment and services necessary to install oil hydraulic passenger type elevators as indicated in the drawings. Install elevator systems as described with all needed accessories as required to provide a complete installation.

1.02 RELATED SECTIONS

A. Refer to other sections of these specifications for related work which is not of this section, including electrical service for elevator systems, hoistway, pit and machinery enclosure with access, lighting, ventilation and services.

B. Electrical Contractor: Provide the following:

1. A fused disconnect switch or circuit breaker per the National Electrical Code with feeder or branch wiring to controller. Size to suit elevator Contractor.
2. A 120 volt A.C., single phase power supply with fused SPST disconnect switch with feeder wiring to each controller for car lights.
3. Convenience outlet and light fixture in pit with switch located adjacent to the access door.
4. Heat or smoke or products of combustion sensing devices, located as indicated with wiring from the sensing devices to elevator controller.
5. Telephone system wiring to machine room.

C. Pit Access Ladder: Section 05 50 00.

1.03 QUALITY ASSURANCE

A. Manufacturer

1. Regularly engaged in designing, engineering, manufacturing, installing and servicing elevators of the type and character specified.
2. Have a history, during the last ten (10) years, of not less than 50 successful installations and satisfied Owners where continuous maintenance service was performed. Such history to be fully documented, upon request, listing project name, date of installation, address, architect, owner, name and phone number of owner's facilities manager or maintenance superintendent.
3. Provide evidence that a service office with qualified service personnel is located within 50 miles of the installation and warehouse parts is

maintained within 50 miles. Where service facilities are further than the specified distances, manufacturer to provide response time of not more than 1-1/2 hours to request of service.

B. Installer: Manufacturer or an authorized agent of the manufacturer with not less than 5 years of successful experience installing similar elevators.

C. Handicapped Provisions: Comply with National Elevator Industry Inc. (NEII) "Suggested Minimum Passenger Elevator Requirements for the Handicapped", and A.D.A. requirements, including clearances, handrails, locations for signal equipment and similar provisions.

D. Codes and Standards: Perform all work in accordance with the American National Standard Safety Code for Elevators, Dumbwaiters, Escalators and Moving Walks (ANSI A17.1), the National Electrical Code and the [OBC] [IBC].

E Regulatory Requirements

1. ASME A17.1 Safety Code for Elevators and Escalators, latest edition or as required by the local building code.
2. OBC.
3. NFPA 70 National Electrical Code.
4. NFPA 80 Fire Doors and Windows.
5. Americans with Disabilities Act - Accessibility Guidelines (ADAAG).

F. Fire-rated entrance assemblies: Opening protective assemblies including frames, hardware and operation shall comply with ASTM E152, UL 10B and NFPA Standard 80. Provide entrance assembly units bearing UL Class B labels.

G. Obtain and pay for all required permits, inspections and fees. Arrange for and make required inspections and tests. Obtain certificates and operating permits and turn over to Owner upon acceptance of work.

1.04 SUBMITTALS

A. Product Data: Submit manufacturer's product specifications and installation instructions for each principal component or product, and include certified test reports on required testing. List and describe features of the control system, performances and operating characteristics.

B. Shop Drawings: Submit plans, elevations and details of car enclosures and hoistway entrances. Include:

1. A comparison of maximum loads imposed on the building structures at points of support and all similar considerations of the elevator work.

C. Service/Maintenance Tools and Documents

1. Maintenance Manuals: Submit bound maintenance manuals for each

elevator with operating and maintenance instructions, parts listing, recommended parts inventory listing, purchase source listing, emergency instructions, maintenance control plan, and similar information.

D. Samples: Submit samples of exposed finishes of car enclosures, hoistway entrances, and signal equipment; 8" squares of materials and 12" lengths of running materials.

E. Inspection certificates and operating permits required by governing authorities to allow normal, unrestricted use of elevator.

F. Deliver permit to operate elevator to Architect.

1.05 DELIVERY, STORAGE AND HANDLING

A. Do not deliver materials to the site until areas in which they are to be installed are ready to receive them in place for final installation.

B. Wrap, carton and crate factory finished materials in a manner to protect finishes.

C. Store, protect and handle materials in accordance with manufacturer's recommendations to prevent damage, soiling or deterioration.

D. Fully protect movable and operating equipment from weather damage.

1.06 PROJECT CONDITIONS

A. Painting

1. Paint all equipment that is not factory finished.
2. Provide all ferrous metals installed in the hoistway shop primed with a rust inhibitive primer.

B. Prohibited Use: Elevators shall not be used for any purpose during the construction period before Substantial Completion.

1.07 MAINTENANCE

A. Provide full preventative maintenance for a period of one year beginning on the date of final acceptance of work.

1. Frequency: Regular and systematic inspections not less than once every other week.
2. Duration: One hour per visit.
3. Personnel: Competent and trained employees of the elevator manufacturer.
4. Maintenance: Includes necessary adjustments, greasing, oiling, cleaning, supplies and parts to keep equipment in proper operation, except such

parts made necessary by misuse, accidents or negligence not caused by the manufacturer.

5. Work Period: Perform all work during regular working hours of the manufacturer's maintenance personnel.

B. Maintenance Service: To be performed solely by the successful elevator manufacturer and not assigned or transferred to any agent or subcontractor.

C. Provide twenty-four hour emergency callback service as part of the maintenance service. If passenger entrapment is involved, a 45 minute response time is required on callbacks.

D. Contractor to have a service office and full-time service personnel within a 50 mile radius of project site. Service office shall have been functioning with full-time personnel for a minimum period of 5 years before the bid date. Two competent, trained employees of the contractor must live within the 50 mile radius.

1.09 WARRANTY

A. Provide special project guaranty, signed by the Contractor, Installer and Manufacturer, agreeing to replace/repair/restore defective materials and workmanship of the elevator work for a period of one year after date of completion.

B. "Defective" is hereby defined to include, but not be limited to, operation or control system failures, performances below required minimums, excessive wear, unusual deterioration or aging of materials or finishes, unsafe conditions, the need for excessive maintenance, abnormal noise or vibration, and similar unusual, unexpected and unsatisfactory conditions.

C. Repairs to be made at no additional cost to the Owner.

PART 2 PRODUCTS

2.01 GENERAL DESCRIPTION

A. Manufacturer Basis of design: Products/models by OTIS ELEVATOR. Products/models by THYSSEN/KRUPP or SCHINDLER may be bid provided they meet all detailed requirements of the following specification. Any deviation from these specifications shall be brought to the Architect's attention during bidding.

B. Description – Passenger Elevator

1. Type: Vegetable-based oil hydraulic cylinder type with buried cylinder and casing.
2. Capacity: 3,500 lbs.
3. Car Speed: 150 fpm.
4. Operation: Simplex collective.
5. Travel: See drawings.
6. Stops: 4.

7. Openings: 4 front.
8. Opening Size: 3’-6” x 7'.
9. Door Operation: Automatic, D.C. power; infrared detection device; timing device.
10. Car - Clear Inside: Approximately 6'-8" wide x 5'-5" deep by 8'-0".
11. Power Supply: 460 V, 3 phase 60 Hz.
12. Lighting and Machinery: 120 v, 1 phase 60 Hz.
13. Machine Location: As indicated on drawings.
14. Priority Dispatching Floor: Floor 2.
15. Elevator connected to Owner’s emergency generator.
16. Motor: 50 HP.

2.02 MATERIALS, GENERAL

A. Colors, patterns, and finishes: As selected by the Architect from manufacturer's full range of standard colors, patterns, and finishes.

B. Steel

1. Shapes and Bars: ASTM A 36.
2. Sheet: ASTM A 366, cold-rolled steel sheet, commercial quality, Class 1, matte finish, stretcher leveled.
3. Finish: Factory-applied baked enamel.

C. Stainless Steel

1. Shapes and Bars: ASTM A 276, Type 304 (18-8).
2. Tubing: ASTM A 269, Type 304 (18-8).
3. Finish: NAAMM No. 4 satin finish.

D. Bronze

1. Drawn Pipe: ASTM B 43, alloy UNS C23000, red brass.
2. Sheet: ASTM B 36, alloy UNS C28000, muntz metal.
3. Extrusions: ASTM B 455, alloy UNS C38500, architectural bronze.
4. Finish: Natural satin finish, lacquered.

E. Aluminum

1. Sheet and Plate: ASTM B 209, alloy 6063-T52.
2. Extrusions: ASTM B 221, alloy 6063-T52.
3. Finish: NAAMM, clear anodized AA M10C22A31.
3. Finish: AAMA, 605.2 high performance organic coating.

F. Nickel Silver: ASTM B 151 extrusions, alloy UNS No. C74500, polished finish.

G. Plastic Laminate: Decorative high-pressure type, complying with NEMA LD3, Type GP-50 General Purpose Grade, nominal 0.050" thickness.

1. Color/Pattern: As selected by Architect from plastic laminate manufacturer's complete line.

H. Wood

1. Veneer: Plain sliced, Grade AA, Red Oak hardwood veneer, complying with AWI Section 200.
2. Solid wood: Plain sawn, Grade I, Red Oak hardwood, complying with AWI Section 100.
3. Finish: Transparent finish system complying with AWI Section 1500 System TR-2, catalyzed lacquer.

I. Glass: Clear laminated safety glass, complying with ANSI Z97.1, nominal 9/16" thickness.

J. Carpet: See Section 09 68 16.

J. Sheet Vinyl: See Section 09 65 00.

2.03 HOISTWAY EQUIPMENT

A. Platform: Fabricated frame of formed or structural steel shapes, gusseted and rigidly welded with a wood subfloor. Underside of the platform shall be fireproofed.

B. Sling: Steel stiles affixed to a steel crosshead and bolstered with bracing members to remove strain from the car enclosure.

C. Guide Rails: Steel; fastened to the building with steel brackets.

D. Guide Shoes: Mounted on top and bottom of the car and be held in contact with the guide rail by adjustable devices.

E. Buffers: Provide code compliant buffers in the elevator pit.

F. Twin Telescoping Jacks: Units of sufficient size to lift the gross load to the height specified. Factory test jack to insure adequate strength and freedom from leakage. Brittle material, such as gray cast iron, is prohibited in the jack construction. Jack unit shall consist of the following components:

1. Two heavy seamless steel tubing plungers accurately turned and polished.
2. Stop ring shall be electrically welded to the plunger to positively prevent plunger leaving the cylinder.
3. Packing or seal of suitable design and quality.
4. Drip ring around cylinder top.
5. Cylinder made of steel pipe and provided with a pipe connection and air bleeder.
6. Jack synchronization: The two plungers shall resynchronize periodically by microprocessor based controls to ensure smooth, accurate performance.]

G. Automatic Terminal Limits: Place electric limit switches in the hoistway near the terminal landings. Limit switches shall be designed to cut off the electric current and stop the car if it runs beyond either terminal landing.

H. Leveling Device: Provide elevator with an automatic leveling device which will bring the car to a stop within 1/4" of landing level regardless of load or direction of travel. Landing level will be maintained within the leveling zone irrespective of the hoistway doors being opened or closed.

I. Failure Protection: Design electrical control circuit so if a malfunction occurs, due to motor starter failure, oil becoming low in the system, or the car failing to reach a landing in the up direction within a pre-determined time, the elevator car will automatically descend to the lowest terminal landing. If power operated doors are used, the doors will automatically open when the car reaches that landing to allow passengers to depart. The doors will then automatically close and all control buttons, except the "door open" button in the car station, shall be made inoperative.

J. Wiring, Piping, and Oil: Provide all necessary hoistway wiring in accordance with the National Electrical Code. All necessary pipe and fittings shall connect the power unit to the jack unit. Provide proper grade oil.

2.04 POWER UNIT

A. Power Unit (Oil Pumping and Control Mechanism): A self-contained unit consisting of the following items:

1. Oil reservoir with tank cover and controller compartment with cover.
2. An oil hydraulic pump.
3. An electric motor.
4. Oil control unit with the following components built into single housing; high pressure relief valve, check valve, automatic unloading up start valve, lowering and leveling valve, and magnetic controller.

C. Pump: Positive displacement screw type to give smooth operation, especially designed and manufactured for elevator service.

D. Drive: Drive shall be by direct coupling with the pump and motor submerged in the oil reservoir or by multiple V-belts and sheaves of number and size to insure maximum factor of safety. Drive type shall be determined based primarily on the load on the car, travel, and speed.

E. Motor: Standard manufacture motor specifically designed for oil-hydraulic elevator service. Duty rating shall comply with specified speeds and loads.

F. Oil Control Unit: The following components shall be built into a single housing. Welded manifolds with separate valves to accomplish each function are not acceptable. Adjustments shall be accessible and be made without removing the assembly from the oil line.

1. Relief valve shall be externally adjustable and be capable of bypassing the total oil flow without increasing back pressure more than 10 percent above that required to barely open the valve.
2. Up start and stop valve shall be externally adjustable and designed to bypass oil flow during start and stop of motor pump assembly. Valve shall close slowly, gradually diverting oil to or from the jack unit, ensuring smooth up starts and up stops.
3. Check valve shall be designed to close quietly without permitting any perceptible reverse flow.
4. Lowering valve and leveling valve shall be externally adjustable for drop-away speed, lowering speed, leveling speed and stopping speed to ensure smooth "down" starts and stops. The leveling valve shall be designed to level the car to the floor in the direction the car is traveling when slowdown is initiated.

G. Power controller shall contain electrical contactors, electro-mechanical switches and thermal overload relays. Mount components in a NEMA 1 enclosure. Logic control system shall be microprocessor based and protected from environmental extremes and excessive vibrations.

H. Reduced Voltage Starting: Provide a solid state starter to limit current inrush during starting and to provide gradual acceleration of the motor. Motor starting shall not be initiated by mechanical contacts. Starter shall include a current limit adjustment range of 200 percent to 450 percent of the overload adjustment range. Provide an integral fault detection and diagnostic system.

2.05 HOISTWAY ENTRANCES

A. Doors and Frames: Provide complete hollow metal type hoistway entrances at each hoistway opening.

1. Manufacturer's standard entrance design, bearing Underwriters' Laboratories "B" labels, and consisting of 14 gauge frames with 2 inch profile, 16 gauge doors, hangers, hanger supports, hanger covers, fascia plates, sight guards, and necessary hardware.
2. Elevator wall interface with hoistway entrance assembly shall comply with elevator manufacturer's requirements.
3. Doors: Flush construction.
   a. Steel: ASTM A 366 steel panels, factory-applied baked enamel finish.
4. Frames: Formed construction.
   a. Steel: ASTM A 366 formed steel, factory-applied baked enamel finish.

B. Interlocks: Equip each hoistway entrance with an Underwriters' Laboratories "B" label approved type interlock tested as required by code. Design interlock to prevent operation of the car away from the landing until the doors are locked in the closed position as defined by code and prevent opening the doors at any landing from the corridor side unless the car is at rest at that landing or is in the leveling zone and stopping at that landing.

C. Door Hanger and Tracks: Provide sheave type two point suspension hangers and tracks for each hoistway sliding door.

1. Sheaves: Polyurethane tires with ball bearings properly sealed to retain grease.
2. Hangers: Provide an adjustable slide to accommodate the up-thrust of the doors.
3. Tracks: Drawn steel shapes, smooth surface and shaped to conform to the hanger sheaves.

D. Hoistway Sills: Extruded, with grooved surface, 1/4 inch thickness.

1. Aluminum: ASTM B 221 aluminum, mill finish.

2.06 CAR ENCLOSURE

A. Car Enclosure

1. Walls: Reinforced 16 gauge cold-rolled steel with two coats factory applied baked enamel finish.
2. Canopy: Reinforced 14 gauge cold-rolled steel with hinged exit. Finish: Two coats factory applied reflective baked enamel.
3. Ceiling: Disc light type, metal panels with circular cutouts and translucent diffusers mounted in a baked enamel metal frame with fluorescent lighting at 7'-4" above the finished floor.
   a. Metal panels: Steel, factory applied baked enamel finish.
4. Cab Columns, Front, and Transom: Steel, factory applied baked enamel finish.
5. Doors: Horizontal sliding car doors reinforced with steel for panel rigidity. Hang doors on sheave type hangers with polyurethane tires that roll on a polished steel track and are guided at the bottom by non-metallic shoes sliding in a smooth threshold groove.
   a. Door Finish: Steel, factory applied baked enamel finish.
   b. Cab Sills: Extruded, with grooved surface, 1/4 inch (6.4 mm) thickness.
      1) Aluminum: ASTM B 221 aluminum, mill finish.
6. Handrail: Continuous contoured [plank] type Red Oak wood handrail, nominal 2" x 4", stained and lacquered. Provide at rear/side walls only.
7. Ventilation: Two speed exhaust fan mounted on the car top.
8. Pad Buttons: Provide pad buttons on cab front(s) and walls.
   a. Provide one set of vinyl protection pads for the project.
9. Base: Stainless steel satin finish.

10. Finished Floor: Carpet provided under Section 09 68 16.

B. Car Top Inspection: Provide a car top inspection station with an "emergency stop" switch and constant pressure "up-down" direction buttons to make the normal operating devices inoperative and give the inspector complete control of the elevator. Mount the car top inspection station in the door operator assembly.

2.07 DOOR OPERATION

A. Door Operation: Provide a direct current motor driven heavy duty operator designed to operate the car and hoistway doors simultaneously. Door movements shall be electrically cushioned at both limits of travel and the door operating mechanism shall be arranged for manual operation in event of power failure. Doors shall automatically open when the car arrives at the landing and automatically close after an adjustable time interval or when the car is dispatched to another landing. Direct drive geared operators, AC controlled units with oil checks, or other deviations are not acceptable.

1. No Un-Necessary Door Operation: Car door shall open only if the car is stopping for a car or hall call, answering a car or hall call at the present position or selected as the next car up.
2. Door Open Time Saver: If a car is stopping in response to a car call assignment only (no coincident hall call), the current door hold open time is changed to a shorter field programmable time when the electronic door protection device is activated.
3. Double Door Operation: When a car stops at a landing with concurrent up and down hall calls, no car calls, and no other hall call assignments, the car door opens to answer the hall call in the direction of the car's current travel. If an onward car call is not registered before the door closes to within 6 inches of fully closed, the travel will reverse and the door will reopen to answer the other call.

B. Electronic Passenger Sensing Device with Nudging: Provide at each entrance a solid state electronic detector and an electro-mechanical reversal edge as follows:

1. After a stop is made, doors shall remain open for an adjustable time interval. Closing may be initiated instantaneously by registration of a car call, operation of load weighing device or signal from the service demand integrator.
2. Doors will remain open as long as the electronic detector senses the presence of a passenger or object in the door opening. If door movement is obstructed for a predetermined time, a buzzer will sound and doors will close at a reduced speed. If the reversal edge contacts a person or object while closing, doors will immediately stop and resume closing after the obstruction has been removed.
3. Electronic Passenger Sensing Device (Light Ray Device)
   a. Provide infra-red light ray device in elevator car entrance. Provide complete, operational system.
      1) Light Curtain: Minimum 40 beam, evenly spaced from floor

to 6'-0" above floor.

2) Control Module: Top of car mounting.
3) Transmitter: Mounted in housing on left or right door jamb.
4) Reciever: Mounted in housing on door jamb opposite transmitter.
5) Housing: Gage as recommended by manufacturer.
6) Electrical: 110 VAC 6VA.

2.08 CAR OPERATING STATION

A. Car Operating Panel: Flush mounted stainless steel panels, containing call button for each landing served, and containing other buttons, switches and controls required for specified car operation and control. These include, but are not limited to, emergency lighting and alarm bell, key operated stop switch, key operated lights and key operated single-speed fan switch, key operated car top inspection switch, key operated independent service key switch, and all necessary safety functions and firefighter service and code required functions.

1. All key switches are to be keyed in accordance with Owner's finish hardware master keying system. See Section 08 71 10.
2. Stainless Steel Panel Finish: #4 satin.
3. Provide operating device symbols as required by code. Mark other buttons and switches with manufacturer's standard identification, including Braille next to buttons, for required use or function.
4. Mount controls at height complying with ANSI A117.1 requirements for handicapped.
5. Provide illuminated buttons, which light up when activated and remain illuminated until call or other function has been fulfilled. Provide non-illuminated buttons with brushed stainless steel finish.

B. "Hands Free Communication": Push button activated, vandal resistant in a speaker/microphone enclosure complying to A.D.A. requirements.

C. In-Car Travel Direction Lanterns: Mounted in car entrance jamb visible from corridor. Illuminates to indicate direction of car travel. Provide with chime which sounds once for "UP" direction and twice for "DOWN" direction as doors are opening.

D. Position Indicator: An electronic dot matrix position indicator mounted in a module matching the control panel. As the car travels, its position in the hoistway shall be indicated by the illumination of the alpha/numeric character corresponding to the landing which the elevator is stopped or passing.

E. Emergency Light: An emergency light and capacity plate shall be integrated into a module. Emergency light shall illuminate automatically upon loss of the building's normal power supply.

2.09 CAR OPERATION SYSTEM

A. Simplex Collective Operation: Using a microprocessor-based controller, operation shall be automatic by means of the car and hall buttons. If all calls in the system have been answered, the car shall park at the last landing served.

B. Battery-Powered Lowering: When power fails, cars are lowered to the lowest floor, open their doors, and shut down. System includes rechargeable battery and automatic recharging system.

2.10 HALL STATIONS

A. Hall Stations, General: Illuminated buttons indicating a call has been registered at that floor for the indicated direction. Faceplates shall be No. 4 satin finish stainless steel. Provide one set of risers.

1. Each terminal station shall contain one illuminating pushbutton.
3. Phase 1 firefighters service keyswitch, with instructions, shall be incorporated into the hall station at the designated level.

B. Floor Identification Pads: Provide door jamb pads at each floor. Jamb pads shall comply with Americans with Disabilities Act (ADA) requirements.

C. Hall Lanterns: Install a hall lantern with an audible signal at each landing entrance for each elevator. The lanterns, when illuminated, shall indicate the elevator car which shall stop at the landing and in what direction the car is set to travel. When the car reaches a predetermined distance from the floor where it is going to stop, the corresponding hall lantern shall illuminate and the signal shall sound. The hall lantern shall remain illuminated until the car doors close in preparation for leaving the floor.

1. Faceplates shall be No. 4 satin finish stainless steel.

D. Hall Position Indicator: Dot matrix position indicator mounted in a module for optimum viewing. As the car travels, its' position in the hoistway shall be indicated by the illumination of the alpha/numeric character corresponding to the landing which the elevator is stopped or passing. When hall lanterns are provided, the position indicator shall be combined with the hall lanterns in the same faceplate.

1. Faceplates shall be No. 4 satin finish stainless steel.

2.11 MISCELLANEOUS ELEVATOR COMPONENTS

A. Oil Hydraulic Silencer: Install an oil hydraulic silencer (muffler device) at the power unit location. Silencer shall contain pulsation absorbing material inserted in a blowout proof housing arranged for inspecting interior parts without removing unit from oil line. Rubber hose without blowout proof features will not be acceptable.

B. Vibration Pads: Mount vibration pads under the power unit assembly to isolate the

unit from the building structure.

C. Sound Insulating Panels: When pump and motor are not submerged, provide panels manufactured of reinforced 14 gauge steel with 1 inch thick 1-1/2 pound fiberglass core attached to interior and mounted on all four open sides of the power unit frame.

D. Sound Isolating Couplings: When pump and motor are not submerged, install a minimum of two couplings in the oil line in the machine room between pump and jack.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install elevators as specified in accordance with all governing codes, manufacturer's written direction and ANSI A17.1.

B. Lubricate all equipment in accordance with manufacturer's written instructions.

3.02 CLEAN-UP

A. Remove all unused materials and leave cab and all related areas clean.

3.03 TESTS OF ELEVATOR WORK:

A. Provide Owner representatives, Architect and Construction Manager one week advance notice of all tests, all training and state inspections that are to be performed on elevators so Fire and Equipment, Elevator, and Construction personnel can be available during the test.

B. Laboratory testing: Comply with ANSI/ASME A17.1 required laboratory testing of elevator components, including buffers, interlocks, door contacts, wire rope, connectors, fasteners, materials and products used in elevator work. Label such products and materials to indicate testing and certification by laboratory.

C. Acceptance testing: Upon nominal completion of elevator installation, and before permitting use of elevator, perform code required acceptance tests. Submit copies of certified test reports to Construction Manager.

D. Owner reserves the right to engage a third party consultant to perform work progress evaluations and/or final approval evaluations.

E. At the time of contract completion, each car shall be loaded with its full test weight and run continuously for 30 minutes in the presence of the owner’s representative. The test runs shall run from the top to the bottom and stop at every floor in between.

3.04 DEMONSTRATION

A. Instruct Owner's personnel in proper use, operations, and daily maintenance of elevators. Review emergency provisions, including emergency access and procedures to be followed at time of failure in operation and other building emergencies. Train Owner's personnel in normal procedures to be followed in checking for sources of operational failures or malfunctions.

B. Make a final check of each elevator operation, with Owner's personnel present, immediately before date of substantial completion. Determine that control systems and operating devices are functioning properly.

END OF SECTION

SECTION 14 28 16

ELEVATOR CONTROLS AND FINISHES

PART 1 GENERAL

1.01 WORK INCLUDED

A. Provide all labor, materials, equipment and services necessary to install car operating panels, corridor call buttons, lighting and accessories as described below in accordance with the American Disability Act. The elevator systems as described shall be installed with all needed accessories as required to provide a complete installation.

1. Remove existing car operating panels and replace.
2. Install corridor call button and cover plate to be located as indicated on drawings.
3. Provide audible signals.
4. Provide emergency light.
5. Provide new cab finishes (wall panels, flooring, handrail and ceiling).

1.02 GENERAL REQUIREMENTS

A. Prior to the start of any work, but less than three weeks after the contract has been awarded, submit the following for approval:

1. Project completion schedule identifying dates and length of down time for the elevator.

B. Upon completion of the work, submit four copies of the following:

1. As built point-to-point control diagrams.
2. Operation, maintenance and parts manual for all equipment.

1.03 QUALITY ASSURANCE

A. Manufacturer: Manufacturer regularly engaged in designing, engineering, manufacturing, installing and servicing elevator equipment of the type and character specified.

B. Installer: Manufacturer or an authorized agent of the manufacturer with not less than 5 years of successful experience installing similar elevator equipment within a 75 mile radius of Columbus, Ohio.

C. Handicapped Provisions: Comply A.D.A. requirements, including clearances, handrails, locations for signal equipment and similar provisions.

D. Codes and Standards: Perform all work in accordance with the American National Standard Safety Code for Elevators, Dumbwaiters, Escalators and Moving Walks (ANSI A17.1), the National Electrical Code and the OBC.

E. Firefighter's Service: Provide in accordance with ANSI/ASME A17.1. At first floor landing.

1.04 SUBMITTALS

A. Product Data: Submit manufacturer's product specifications.

B. Shop Drawings: Submit plans, elevations and details of new equipment verses the existing equipment.

C. Maintenance Manuals: Submit bound maintenance manual with operating and maintenance instructions, parts listing, recommended parts inventory listing, purchase source listing, emergency instructions and similar information.

D. Inspection certificates and operating permits required by governing authorities to allow normal, unrestricted use of elevators.

E. Deliver permit to operate elevator to CM.

1.05 DELIVERY, STORAGE AND HANDLING

A. Do not deliver materials to the site until areas in which they are to be installed are ready to receive them in place for final installation. No overnight site storage is available. Coordinate deliveries with CM.

B. Wrap, carton and crate factory finished materials in a manner to protect finishes.

C. Store, protect and handle materials in accordance with manufacturer's recommendations to prevent damage, soiling or deterioration.

1.06 PROJECT CONDITIONS

A. Obtain and pay for all required permits, inspections and fees. Arrange for and make required inspections and tests. Obtain certificates and operating permits and turn over to Owner upon acceptance of work.

1.07 GUARANTEES

A. Provide special project guarantee, signed by Installer and Manufacturer, agreeing to replace/repair/restore defective materials and workmanship of the elevator controls work for a period of one year after date of completion.

B. "Defective" is hereby defined to include, but not be limited to, operation or control system failures, performances below required minimums, excessive wear, unusual deterioration or aging of materials or finishes, unsafe conditions, the need for excessive maintenance, and similar unusual, unexpected and unsatisfactory conditions.

C. Repairs to be made at no additional cost to the Owner.

D. Date of completion shall be the date of acceptance by CM/Architect/Owner after permit is secured. Inspection for acceptance to be within 14 days of delivery of permit to Architect.

PART 2 PRODUCTS

2.01 GENERAL DESCRIPTION

A. General: The following materials and equipment are based on INNOVATION INDUSTRIES INC. specifications. Similar products by GAL and ADAMS may be bid provided they meet detailed requirements of the following specification. Any deviation from these detailed specifications shall be brought to the Architect's attention prior to bidding.

2.02 CONTROLS AND FIXTURES

A. Car Operating Panel

1. Provide operating panels, containing devices required for the specific operation, mounted in each car on the front return.
2. Panels include illuminated push buttons of construction to restrict vandalism; and tamper resistant fittings and connections. Provide with tactile/Braille inserts.
3. Provide push buttons marked to correspond to the landings served, an "emergency stop" switch, a "door open" button, a "door close" button, fan and light switch, and an independent service key switch.
4. Provide firefighter's service key switch, jewel, fire and call cancel button.
5. Floor buttons are illuminated when a call has been registered, and remains illuminated until car reaches the indicated floor.
6. Operation of the "emergency stop" switch in the car, in addition to stopping the car, sounds audio alarm bell.
7. "Hands Free Communication": Push button activated, vandal resistant in a speaker/microphone enclosure. Button to function to initiate call to security control room separate from alarm.

B. Car Position Indicator: LED type digital display flush mounted in car station panel.

C. Hall Call Stations: Vandal resistant, push buttons. Provide at each landing.

1. Provide intermediate stations consisting of two push buttons, one for up and one for down. Button to illuminate when pressed for desired direction.

2. Provide terminal stations with one push button.
3. Remove existing push button and face plate and provide new hall station faceplates with a polished stainless steel finish at ADA compliant height. New cover plates to cover existing button box and new box location with one cover plate at terminal and intermediate stations.

D. Hall Lanterns: Audible signal at each landing entrance indicating the elevator car which will stop at the landing and in which direction the car is set to travel.

1. Audible Signal: Provide electronic chime to sound one tone for up and two tones for down.
2. As car reaches a predetermined distance from a floor at which it is going to stop, corresponding hall lantern shall be illuminated and audible signal shall sound.

E. Push Buttons

1. VPW Series by GAL ELEVATOR DEVICES or equal by other listed manufacturers.
   a. Car operating panel buttons to have recessed floor number.
   b. Hall call station buttons to have directional arrow.

2.03 ELEVATOR COMPONENTS

A. General Equipment

1. Emergency Fire Service: In accordance with National Elevator Code ANSI A17.1.
2. Exposed Fasteners: All exposed fasteners shall be Allen head with center pin, countersunk flat head security screws.
3. Tamper resistant: Provide all exposed signals and controls as extra heavy duty, vandal proof, tamper proof and nonbreakable as is reasonably possible to accomplish.

B. Door Standing Time Saver: Reset the door open time to meet time requirements set forth by ADA guidelines.

C. Variable Door Time: Doors shall remain open for an adjustable time for a stop in response to a car call and a second variable time for a stop in response to a hall call. If either beam of the electronic detector is interrupted and reestablished, door open time for a car stop and for a hall stop shall be reduced.

D. Electronic Passenger Sensing Device with Nudging: Provide at each entrance a solid state electronic detector and an electro-mechanical reversal edge as follows:

1. After a stop is made, doors shall remain open for an adjustable time interval. Closing may be initiated instantaneously by registration of a car call, operation of load weighing device or signal from the service demand integrator.

2. Doors will remain open as long as the electronic detector senses the presence of a passenger or object in the door opening. If door movement is obstructed for a predetermined time, a buzzer will sound and doors will close at a reduced speed. If the reversal edge contacts a person or object while closing, doors will immediately stop and resume closing after the obstruction has been removed.
3. Arrange circuitry to inactivate the electronic detector should it fail to operate. However, the electro-mechanical reversing edge will not be deactivated by failure of the electronic detector or its removal from the circuitry by means of a manual switch.
4. Electronic Passenger Sensing Device (Light Ray Device)
    a. Provide infa-red light ray device in elevator car entrance. Provide complete, operational system.
        1) Light Curtain: 40 beam, evenly spaced from floor to 6'-0" above floor.
        2) Control Module: Top of car mounting.
        3) Transmitter: Mounted in housing on left or right door jamb.
        4) Receiver: Mounted in housing on door jamb opposite transmitter.
        5) Housing: Gage as recommended by manufacturer.
        6) Electrical: 110 VAC 6VA.
    b. Manufacturer: Panaforty by JANUS.

2.04 MISCELLANEOUS

A. Handicapped markings: Provide car control markings in compliance with ANSI/ASME Handicapped Requirements.

B. Emergency Car Lighting: Provide an emergency power unit employing a 12-volt sealed rechargeable battery and totally static circuits to illuminate the elevator car and provide current to the alarm bell in the event of normal power failure. Provide equipment complying with the requirements of ANSI/ASME Code.

C. Audible Signals

1. Provide an audible signal that sounds in the car to tell a passenger that the car is either stopping or passing a floor served by the elevator.
2. Audible Signal: Provide electronic chime to sound one tone for up and two tones for down.

D. Firefighter Service: Equip elevator with devices and circuits to provide firefighters' service in accordance with Phase I and Phase II of the National Elevator Code ANSI/ASME A17.1.

2.05 CAR FINISHES

A. Wall Panels: Applied panels of fire-rated wood core construction faced on both sides with plastic laminate.

1. Plastic Laminate: Selected by Associate Architect from plastic laminate manufacturer's complete line of colors and patterns.

B. Existing Metal Enclosure: Prepare surface and repaint with enamel paint. Color as selected by Architect.

C. Front Return, Entrance Column and Transom: Prepare surface and repaint with enamel paint. Color as selected by Architect.

D. Doors: Prepare surface and repaint with enamel paint. Color as selected by Architect.

E. Ceiling: Suspended with plastic grid diffuser in baked enamel steel frame and fluorescent lights above.

F. Handrail: 2" brushed stainless steel finished bar on two sides for elevators opening front and rear; three sides for elevator opening front only.

G. Flooring: Sheet carpet. See Section 09 68 16.

H. Lighting: Two 4' long fluorescent fixtures mounted above ceiling grid/diffuser.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install elevator equipment, finishes and lighting as specified in accordance with all governing codes in accordance with manufacturer's written direction, ANSI A17.1, and all current ADA requirements.

3.02 CLEAN-UP

A. Remove all unused materials and leave cab and all related areas clean at the end of each working day.

B. Keep areas surrounding all running elevator entrances clear of materials and equipment.

END OF SECTION

SECTION 210517
SLEEVES AND SLEEVE SEALS FOR FIRE-SUPPRESSION PIPING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Sleeves.
2. Sleeve-seal systems.
3. Grout.

1.02 ACTION SUBMITTALS

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

PART 2 - PRODUCTS

2.01 SLEEVES

A. Cast-Iron Wall Pipes: Cast or fabricated of cast or ductile iron and equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.

B. Galvanized-Steel Wall Pipes: ASTM A 53/A 53M, Schedule 40, with plain ends and welded steel collar; zinc coated.

C. Galvanized-Steel-Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, with plain ends.

D. PVC-Pipe Sleeves: ASTM D 1785, Schedule 40.

E. Galvanized-Steel-Sheet Sleeves: 0.0239-inch (0.6-mm) minimum thickness; round tube closed with welded longitudinal joint.

2.02 SLEEVE-SEAL SYSTEMS

A. Description: Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.

1. Sealing Elements: EPDM-rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
2. Pressure Plates: Carbon steel.
3. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating of length required to secure pressure plates to sealing elements.

2.03 GROUT

A. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.

B. Characteristics: Nonshrink; recommended for interior and exterior applications.

C. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.01 SLEEVE INSTALLATION

A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.

B. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide 1-inch (25-mm) annular clear space between piping and concrete slabs and walls.

1. Sleeves are not required for core-drilled holes.

C. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.

1. Cut sleeves to length for mounting flush with both surfaces.

a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches (50 mm) above finished floor level.

2. Using grout, seal the space outside of sleeves in slabs and walls without sleeve-seal system.

D. Install sleeves for pipes passing through interior partitions.

1. Cut sleeves to length for mounting flush with both surfaces.
2. Install sleeves that are large enough to provide 1/4-inch (6.4-mm) annular clear space between sleeve and pipe or pipe insulation.
3. Seal annular space between sleeve and piping or piping insulation; use joint sealants appropriate for size, depth, and location of joint. Comply with requirements for sealants specified in Section 079200 "Joint Sealants."

E. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements for firestopping specified in Section 078413 "Penetration Firestopping."

3.02 SLEEVE-SEAL-SYSTEM INSTALLATION

A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at service piping entries into building.

B. Select type, size, and number of sealing elements required for piping material and size and for sleeve ID or hole size. Position piping in center of sleeve. Center piping in penetration, assemble sleeve-seal system components, and install in annular space between piping and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal.

3.03 SLEEVE AND SLEEVE-SEAL SCHEDULE

A. Use sleeves and sleeve seals for the following piping-penetration applications:

1. Exterior Concrete Walls above Grade:

    a. Piping Smaller Than NPS 6 (DN 150): Cast-iron wall sleeves.
    b. Piping NPS 6 (DN 150) and Larger: Cast-iron wall sleeves.

2. Exterior Concrete Walls below Grade:

    a. Piping Smaller Than NPS 6 (DN 150): Cast-iron wall sleeves with sleeve-seal system.

        1) Select sleeve size to allow for 1-inch (25-mm) annular clear space between piping and sleeve for installing sleeve-seal system.

    b. Piping NPS 6 (DN 150) and Larger: Cast-iron wall sleeves with sleeve-seal system.

        1) Select sleeve size to allow for 1-inch (25-mm) annular clear space between piping and sleeve for installing sleeve-seal system.

3. Concrete Slabs-on-Grade:

    a. Piping Smaller Than NPS 6 (DN 150): Cast-iron wall sleeves with sleeve-seal system.

        1) Select sleeve size to allow for 1-inch (25-mm) annular clear space between piping and sleeve for installing sleeve-seal system.

    b. Piping NPS 6 (DN 150) and Larger: Cast-iron wall sleeves with sleeve-seal system.

        1) Select sleeve size to allow for 1-inch (25-mm) annular clear space between piping and sleeve for installing sleeve-seal system.

4. Concrete Slabs above Grade:

    a. Piping Smaller Than NPS 6 (DN 150): Galvanized-steel-pipe sleeves.

b. Piping NPS 6 (DN 150) and Larger: Galvanized-steel-pipe sleeves.

5. Interior Partitions:

a. Piping Smaller Than NPS 6 (DN 150): Galvanized-steel-pipe sleeves.
b. Piping NPS 6 (DN 150) and Larger: Galvanized-steel-sheet sleeves.

END OF SECTION 210517

SECTION 210518
ESCUTCHEONS FOR FIRE-SUPPRESSION PIPING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Escutcheons.
2. Floor plates.

1.02 ACTION SUBMITTALS

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

PART 2 - PRODUCTS

2.01 ESCUTCHEONS

A. One-Piece, Cast-Brass Type: With polished, chrome-plated finish and setscrew fastener.

B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with chrome-plated finish and spring-clip fasteners.

C. One-Piece, Stamped-Steel Type: With chrome-plated finish and spring-clip fasteners.

2.02 FLOOR PLATES

A. One-Piece Floor Plates: Cast-iron flange with holes for fasteners.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install escutcheons for piping penetrations of walls, ceilings, and finished floors.

B. Install escutcheons with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.

1. Escutcheons for New Piping:

a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.

b. Chrome-Plated Piping: One-piece, cast-brass type with polished, chrome-plated finish.
c. Insulated Piping: One-piece, stamped-steel type.
d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass type with polished, chrome-plated finish.
e. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, stamped-steel type.
f. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, cast-brass type with polished, chrome-plated finish.
g. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, stamped-steel type.
h. Bare Piping in Unfinished Service Spaces: One-piece, cast-brass type with rough-brass finish.
i. Bare Piping in Unfinished Service Spaces: One-piece, stamped-steel type.
j. Bare Piping in Equipment Rooms: One-piece, cast-brass type with rough-brass finish.
k. Bare Piping in Equipment Rooms: One-piece, stamped-steel type.

C. Install floor plates for piping penetrations of equipment-room floors.

D. Install floor plates with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.

1. New Piping: One-piece, floor-plate type.

3.02 FIELD QUALITY CONTROL

A. Replace broken and damaged escutcheons and floor plates using new materials.

END OF SECTION 210518

SECTION 210523
GENERAL-DUTY VALVES FOR WATER-BASED FIRE-SUPPRESSION PIPING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Iron butterfly valves with indicators.
2. Check valves.
3. Iron OS&Y gate valves.
4. NRS gate valves.
5. Indicator posts.
6. Trim and drain valves.

1.02 ACTION SUBMITTALS

A. Product Data: For each type of valve.

PART 2 - PRODUCTS

2.01 GENERAL REQUIREMENTS FOR VALVES

A. UL Listed: Valves shall be listed in UL's "Online Certifications Directory" under the headings listed below and shall bear UL mark:

1. Main Level: HAMV - Fire Main Equipment.

a. Level 1: HCBZ - Indicator Posts, Gate Valve.
b. Level 1: HLOT - Valves.

1) Level 3: HLUG - Ball Valves, System Control.
2) Level 3: HLXS - Butterfly Valves.
3) Level 3: HMER - Check Valves.
4) Level 3: HMRZ - Gate Valves.

2. Main Level: VDGT - Sprinkler System & Water Spray System Devices.

a. Level 1: VQGU - Valves, Trim and Drain.

B. FM Global Approved: Valves shall be listed in its "Approval Guide," under the headings listed below:

1. Automated Sprinkler Systems:

a. Indicator posts.
b. Valves.

1) Gate valves.
2) Check valves.

a) Single check valves.

3) Miscellaneous valves.

C. Source Limitations for Valves: Obtain valves for each valve type from single manufacturer.

D. ASME Compliance:

1. ASME B16.1 for flanges on iron valves.
2. ASME B1.20.1 for threads for threaded-end valves.
3. ASME B31.9 for building services piping valves.

E. AWWA Compliance: Comply with AWWA C606 for grooved-end connections.

F. NFPA Compliance: Comply with NFPA 24 for valves.

G. Valve Pressure Ratings: Not less than the minimum pressure rating indicated or higher as required by system pressures.

H. Valve Sizes: Same as upstream piping unless otherwise indicated.

I. Valve Actuator Types:

1. Worm-gear actuator with handwheel for quarter-turn valves, except for trim and drain valves.
2. Handwheel: For other than quarter-turn trim and drain valves.
3. Handlever: For quarter-turn trim and drain valves NPS 2 (DN 50) and smaller.

2.02 IRON BUTTERFLY VALVES WITH INDICATORS

A. Description:

1. Standard: UL 1091 and FM Global standard for indicating valves, (butterfly or ball type), Class Number 112.
2. Minimum Pressure Rating: 175 psig (1200 kPa).
3. Body Material: Cast or ductile iron with nylon, EPDM, epoxy, or polyamide coating.
4. Seat Material: EPDM.
5. Stem: Stainless steel.
6. Disc: Ductile iron.
7. Actuator: Worm gear or traveling nut.
8. Supervisory Switch: Internal or external.

2.03 CHECK VALVES

A. Description:

1. Standard: UL 312 and FM Global standard for swing check valves, Class Number 1210.
2. Minimum Pressure Rating: 175 psiga (1200 kPa).
3. Type: Single swing check.
4. Body Material: Cast iron, ductile iron, or bronze.
5. Clapper: Bronze, ductile iron, or stainless steel with elastomeric seal.
6. Clapper Seat: Brass, bronze, or stainless steel.
7. Hinge Shaft: Bronze or stainless steel.
8. Hinge Spring: Stainless steel.
9. End Connections: Flanged, grooved, or threaded.

2.04 IRON OS&Y GATE VALVES

A. Description:

1. Standard: UL 262 and FM Global standard for fire-service water control valves (OS&Y- and NRS-type gate valves).
2. Minimum Pressure Rating: 175 psig (1200 kPa).
3. Body and Bonnet Material: Cast or ductile iron.
4. Wedge: Cast or ductile iron, or bronze with elastomeric coating.
5. Wedge Seat: Cast or ductile iron, or bronze with elastomeric coating.
6. Stem: Brass or bronze.
7. Packing: Non-asbestos PTFE.
8. Supervisory Switch: External.

2.05 NRS GATE VALVES

A. Description:

1. Standard: UL 262 and FM Global standard for fire-service water control valves (OS&Y- and NRS-type gate valves).
2. Minimum Pressure Rating: 175 psig (1200 kPa).
3. Body and Bonnet Material: Cast or ductile iron.
4. Wedge: Cast or ductile iron with elastomeric coating.
5. Wedge Seat: Cast or ductile iron, or bronze with elastomeric coating.
6. Stem: Brass or bronze.
7. Packing: Non-asbestos PTFE.
8. Supervisory Switch: External.

2.06 INDICATOR POSTS

A. Description:

1. Standard: UL 789 and FM Global standard for indicator posts.
2. Extension Barrel: Cast or ductile iron.

3. Cap: Cast or ductile iron.

2.07 TRIM AND DRAIN VALVES

A. Angle Valves:

1. Description:
   a. Body Material: Brass or bronze.
   b. Ends: Threaded.
   c. Stem: Bronze.
   d. Disc: Bronze.
   e. Packing: Asbestos free.
   f. Handwheel: Malleable iron, bronze, or aluminum.

PART 3 - EXECUTION

3.01 GENERAL REQUIREMENTS FOR VALVE INSTALLATION

A. Comply with requirements in the following Sections for specific valve installation requirements and applications:

1. Section 211100 "Facility Fire-Suppression Water-Service Piping" for application of valves in fire-suppression water-service piping outside the building.
2. Section 211200 "Fire-Suppression Standpipes" for application of valves in fire-suppression standpipes.
3. Section 211313 "Wet-Pipe Sprinkler Systems" for application of valves in wet-pipe, fire-suppression sprinkler systems.
4. Section 211316 "Dry-Pipe Sprinkler Systems" for application of valves in dry-pipe, fire-suppression sprinkler systems.
5. Section 211339 "Foam-Water Systems" for application of valves in AFFF piping.

B. Install listed fire-protection shutoff valves supervised-open, located to control sources of water supply except from fire-department connections. Install permanent identification signs indicating portion of system controlled by each valve.

C. Install check valve in each water-supply connection. Install backflow preventers instead of check valves in potable-water-supply sources.

D. Install valves having threaded connections with unions at each piece of equipment arranged to allow easy access, service, maintenance, and equipment removal without system shutdown. Provide separate support where necessary.

E. Install valves in horizontal piping with stem at or above the pipe center.

F. Install valves in position to allow full stem movement.

G. Install valve tags. Comply with requirements in Section 210553 "Identification for Fire-Suppression Piping and Equipment" for valve tags and schedules and signs on surfaces concealing valves; and the NFPA standard applying to the piping system in which valves

are installed. Install permanent identification signs indicating the portion of system controlled by each valve.

H. Install listed fire-protection shutoff valves supervised-open, located to control sources of water supply except from fire-department connections.

I. Install check valve in each water-supply connection. Install backflow preventers instead of check valves in potable-water-supply sources.

END OF SECTION 210523

SECTION 211119
FIRE-DEPARTMENT CONNECTIONS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Exposed-type fire-department connections.
2. Flush-type fire-department connections.

1.02 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each fire-department connection.

PART 2 - PRODUCTS

2.01 EXPOSED-TYPE FIRE-DEPARTMENT CONNECTION

A. Standard: UL 405.

B. Type: Exposed, projecting, for wall mounting.

C. Pressure Rating: 175 psig (1200 kPa) minimum.

D. Body Material: Corrosion-resistant metal.

E. Inlets: Brass with threads according to NFPA 1963 and matching local fire-department sizes and threads. Include extension pipe nipples, brass lugged swivel connections, and check devices or clappers.

F. Caps: Brass, lugged type, with gasket and chain.

G. Escutcheon Plate: Round, brass, wall type.

H. Outlet: Back, with pipe threads.

2.02 FLUSH-TYPE FIRE-DEPARTMENT CONNECTION

A. Standard: UL 405.

B. Type: Flush, for wall mounting.

C. Pressure Rating: 175 psig (1200 kPa) minimum.

D. Body Material: Corrosion-resistant metal.

E. Inlets: Brass with threads according to NFPA 1963 and matching local fire-department sizes and threads. Include extension pipe nipples, brass lugged swivel connections, and check devices or clappers.

F. Caps: Brass, lugged type, with gasket and chain.

G. Escutcheon Plate: Rectangular, brass, wall type.

H. Outlet: With pipe threads.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install wall-type fire-department connections.

B. Install automatic (ball-drip) drain valve at each check valve for fire-department connection.

END OF SECTION 211119

SECTION 211200 - FIRE-SUPPRESSION STANDPIPES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Pipes, fittings, and specialties.
2. Fire-protection specialty valves.
3. Hose connections.
4. Alarm devices.
5. Pressure gages.

B. Related Requirements:

1. Section 210523 "General-Duty Valves for Water-Based Fire-Suppression Piping."
2. Section 211119 "Fire-Department Connections" for exposed wall-mounted and yard fire hydrants.
3. Section 211313 "Wet-Pipe Sprinkler Systems" for wet-pipe sprinkler piping.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For fire-suppression standpipes.

1. Include plans, elevations, sections, and attachment details.

C. Delegated-Design Submittal: For standpipe 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.

1.3 INFORMATIONAL SUBMITTALS

A. Approved Standpipe Drawings: Working plans, prepared according to NFPA 14, that have been approved by authorities having jurisdiction, including hydraulic calculations if applicable.

B. Fire-hydrant flow test report.

C. Field Test Reports and Certificates: Indicate and interpret test results for compliance with performance requirements and as described in NFPA 14. Include "Contractor's Material and Test Certificate for Aboveground Piping" and "Contractor's Material and Test Certificate for Underground Piping."

D. Field quality-control reports.

1.4 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.5 QUALITY ASSURANCE

A. Installer Qualifications:

1. Installer's responsibilities include designing, fabricating, and installing fire-suppression standpipes and providing professional engineering services needed to assume engineering responsibility. Base calculations on results of fire-hydrant flow test.

a. Engineering Responsibility: Preparation of working plans, calculations, and field test reports by a qualified professional engineer.

B. NFPA Standards: Fire-suppression standpipe equipment, specialties, accessories, installation, and testing shall comply with NFPA 14.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTIONS

A. Automatic Wet-Type, Standpipe System: Has open water-supply valve with pressure maintained and is capable of supplying water demand.

2.2 PERFORMANCE REQUIREMENTS

A. Standard-Pressure, Fire-Suppression Standpipe System Component: Listed for 175-psig (1200-kPa) minimum working pressure.

B. Delegated Design: Design fire-suppression standpipes, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

C. Fire-suppression standpipe design shall be approved by authorities having jurisdiction.

D. Seismic Performance: Fire-suppression standpipes shall withstand the effects of earthquake motions determined according to NFPA 13 and ASCE/SEI 7.

2.3 BLACK STEEL PIPE AND ASSOCIATED FITTINGS

A. Schedule 40: ASTM A 53/A 53M, Type E, Grade B; with factory- or field-formed ends to accommodate joining method.

B. Schedule 40: ASTM A 135/A 135M, Grade A; with factory- or field-formed ends to accommodate joining method.

C. Schedule 40: ASTM A 795/A 795M, Type E, Grade A; with factory- or field-formed ends to accommodate joining method.

D. Schedule 30: ASTM A 53/A 53M, Type E, Grade B; with factory- or field-formed ends to accommodate joining method.

E. Schedule 30: ASTM A 135/A 135M, Grade A; with factory- or field-formed ends to accommodate joining method.

F. Schedule 30: ASTM A 795/A 795M, Type E, Grade A; with factory- or field-formed ends to accommodate joining method.

G. Thinwall: ASTM A 53/A 53M, Type E; with wall thickness less than Schedule 30 and equal to or greater than Schedule 10; and with factory- or field-formed ends to accommodate joining method.

H. Thinwall: ASTM A 135/A 135M, Grade A; with wall thickness less than Schedule 30 and equal to or greater than Schedule 10; and with factory- or field-formed ends to accommodate joining method.

I. Thinwall: ASTM A 795/A 795M, Type E, Grade A; with wall thickness less than Schedule 30 and equal to or greater than Schedule 10; and with factory- or field-formed ends to accommodate joining method.

J. Uncoated, Steel Couplings: ASTM A 865/A 865M, threaded.

K. Uncoated, Gray-Iron Threaded Fittings: ASME B16.4, Class 125, standard pattern.

L. Malleable- or Ductile-Iron Unions: UL 860.

M. Cast-Iron Flanges: ASME B16.1, Class 125.

N. Steel Flanges and Flanged Fittings: ASME B16.5, Class 150.

O. Steel Welding Fittings: ASTM A 234/A 234M and ASME B16.9.

P. Grooved-Joint, Steel-Pipe Appurtenances:

1. Pressure Rating: 175 psig (1200 kPa) minimum.
2. Grooved-End Fittings for Steel Piping: ASTM A 47/A 47M, malleable-iron casting or ASTM A 536, ductile-iron casting; with dimensions matching steel pipe.
3. Grooved-End-Pipe Couplings for Steel Piping: AWWA C606 and UL 213, rigid pattern, unless otherwise indicated, for steel-pipe dimensions. Include ferrous housing sections, EPDM-rubber gasket, and bolts and nuts.

2.4 GALVANIZED-STEEL PIPE AND ASSOCIATED FITTINGS

A. Schedule 40: ASTM A 53/A 53M, Type E, Grade B; with factory- or field-formed ends to accommodate joining method.

B. Schedule 40: ASTM A 135/A 135M, Grade A; with factory- or field-formed ends to accommodate joining method.

C. Schedule 40: ASTM A 795/A 795M, Type E, Grade A; with factory- or field-formed ends to accommodate joining method.

D. Galvanized-Steel Pipe Nipples: ASTM A 733, made of ASTM A 53/A 53M or ASTM A 106/A 106M, Standard Weight, seamless steel pipe with threaded ends.

E. Galvanized, Gray-Iron Threaded Fittings: ASME B16.4, Class 125, standard pattern.

F. Malleable-Iron Unions:

1. ASME B16.39, Class 150.
2. Hexagonal-stock body.
3. Ball-and-socket, metal-to-metal, bronze seating surface.
4. Threaded ends.

G. Flanges: ASME B16.1, Class 125, cast iron.

H. Appurtenances for Grooved-End, Galvanized-Steel Pipe:

1. Fittings for Grooved-End, Galvanized-Steel Pipe: Galvanized, ASTM A 47/A 47M, malleable-iron casting; ASTM A 106/A 106M, steel pipe; or ASTM A 536, ductile-iron casting; with dimensions matching steel pipe.
2. Fittings for Grooved-End, Galvanized-Steel Pipe:

a. AWWA C606 for steel-pipe dimensions.
b. Ferrous housing sections.
c. EPDM-rubber gaskets suitable for hot and cold water.
d. Bolts and nuts.

2.5 PIPING JOINING MATERIALS

A. Pipe-Flange Gasket Materials: AWWA C110, rubber, flat face, 1/8 inch (3.2 mm) thick or ASME B16.21, nonmetallic and asbestos free.

1. Class 125, Cast-Iron Flanges and Class 150, Bronze Flat-Face Flanges: Full-face gaskets.
2. Class 250, Cast-Iron Flanges and Class 300, Steel Raised-Face Flanges: Ring-type gaskets.

B. Metal, Pipe-Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.

C. Welding Filler Metals: Comply with AWS D10.12/D10.12M for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

2.6 SPECIALTY VALVES

A. General Requirements:

1. Standard: UL's "Fire Protection Equipment Directory" listing or FM Global's "Approval Guide."
2. Pressure Rating: 175 psig (1200 kPa) minimum.
3. Body Material: Cast or ductile iron.
4. Size: Same as connected piping.
5. End Connections: Flanged or grooved.

B. Alarm Valves:

1. Standard: UL 193.
2. Design: For horizontal or vertical installation.
3. Include trim sets for bypass, drain, electrical sprinkler alarm switch, pressure gages, and fill-line attachment with strainer.
4. Drip Cup Assembly: Pipe drain without valves and separate from main drain piping.
5. Drip Cup Assembly: Pipe drain with check valve to main drain piping.

C. Pressure-Reducing Valves:

1. UL 668 hose valve, with integral UL 1468 reducing device.
2. Pressure Rating: 300 psig (2070 kPa) minimum.
3. Material: Brass or bronze.
4. Inlet: Female pipe threads.
5. Outlet: Threaded with or without adapter having male hose threads.

D. Automatic (Ball Drip) Drain Valves:

1. Standard: UL 1726.
2. Pressure Rating: 175 psig (1200 kPa) minimum.
3. Type: Automatic draining, ball check.
4. Size: NPS 3/4 (DN 20).
5. End Connections: Threaded.

2.7 HOSE CONNECTIONS

A. Nonadjustable-Valve Hose Connections:

1. Standard: UL 668 hose valve for connecting fire hose.
2. Pressure Rating: 300 psig (2070 kPa) minimum.
3. Material: Brass or bronze.
4. Size: NPS 1-1/2 (DN 40), as indicated.
5. Inlet: Female pipe threads.
6. Outlet: Male hose threads with lugged cap, gasket, and chain. Include hose valve threads according to NFPA 1963 and matching local fire-department threads.

2.8 ALARM DEVICES

A. Alarm-device types shall match piping and equipment connections.

B. Water-Motor-Operated Alarm:

1. Standard: UL 753.
2. Type: Mechanically operated, with pelton wheel.
3. Alarm Gong: Cast aluminum with red-enamel factory finish.
4. Size: 10-inch (250-mm) diameter.
5. Components: Shaft length, bearings, and sleeve to suit wall construction.
6. Inlet: NPS 3/4 (DN 20).
7. Outlet: NPS 1 (DN 25) drain connection.

C. Electrically Operated Alarm Bell:

1. Standard: UL 464.
2. Type: Vibrating, metal alarm bell.
3. Finish: Red-enamel factory finish, suitable for outdoor use.

D. Water-Flow Indicators:

1. Standard: UL 346.
2. Water-Flow Detector: Electrically supervised.
3. Components: Two single-pole, double-throw circuit switches for isolated alarm and auxiliary contacts, 7 A, 125-V ac and 0.25 A, 24-V dc; complete with factory-set, field-adjustable retard element to prevent false signals and tamperproof cover that sends signal if removed.
4. Type: Paddle operated.
5. Pressure Rating: 250 psig (1725 kPa).
6. Design Installation: Horizontal or vertical.

E. Pressure Switches:

1. Standard: UL 346.
2. Type: Electrically supervised water-flow switch with retard feature.
3. Components: Single-pole, double-throw switch with normally closed contacts.
4. Design Operation: Rising pressure signals water flow.

F. Valve Supervisory Switches:

1. Standard: UL 346.
2. Type: Electrically supervised.
3. Components: Single-pole, double-throw switch with normally closed contacts.
4. Design: Signals that controlled valve is in other than fully open position.

G. Indicator-Post Supervisory Switches:

1. Standard: UL 346.
2. Type: Electrically supervised.
3. Components: Single-pole, double-throw switch with normally closed contacts.
4. Design: Signals that controlled indicator-post valve is in other than fully open position.

2.9 PRESSURE GAGES

A. Standard: UL 393.

B. Dial Size: 3-1/2- to 4-1/2-inch (90- to 115-mm) diameter.

C. Pressure Gage Range: Zero to 250 psig (Zero to 1725 kPa) minimum.

D. Water System Piping Gage: Include "WATER" or "AIR/WATER" label on dial face.

E. Air System Piping Gage: Include "AIR" or "AIR/WATER" label on dial face.

PART 3 - EXECUTION

3.1 PREPARATION

A. Perform fire-hydrant flow test according to NFPA 14 and NFPA 291. Use results for system design calculations required in "Quality Assurance" Article.

B. Report test results promptly and in writing.

3.2 SERVICE-ENTRANCE PIPING

A. Connect fire-suppression standpipe piping to water-service piping at service entrance into building. Comply with requirements for exterior piping in Section 211100 "Facility Fire-Suppression Water-Service Piping."

B. Install shutoff valve, backflow preventer, pressure gage, drain, and other accessories at connection to fire-suppression water-service piping.

C. Install shutoff valve, check valve, pressure gage, and drain at connection to water service.

3.3 WATER-SUPPLY CONNECTIONS

A. Connect fire-suppression standpipe piping to building's interior water-distribution piping. Comply with requirements for interior piping in Section 221116 "Domestic Water Piping."

B. Install shutoff valve, backflow preventer, pressure gage, drain, and other accessories at connection to water-distribution piping.

C. Install shutoff valve, check valve, pressure gage, and drain at connection to water supply.

3.4 PIPING INSTALLATION

A. Locations and Arrangements: Drawing plans, schematics, and diagrams indicate general location and arrangement of piping. Install piping as indicated, as far as practical.

1. Deviations from approved working plans for piping require written approval from authorities having jurisdiction. File written approval with Architect before deviating from approved working plans.

B. Piping Standard: Comply with requirements in NFPA 14 for installation of fire-suppression standpipe piping.

C. Install seismic restraints on piping. Comply with requirements in NFPA 13 for seismic-restraint device materials and installation.

D. Install listed fittings to make changes in direction, branch takeoffs from mains, and reductions in pipe sizes.

E. Install drain valves on standpipes. Extend drain piping to outside of building.

F. Install automatic (ball drip) drain valves to drain piping between fire-department connections and check valves. Drain to floor drain or outside building.

G. Install alarm devices in piping systems.

H. Install hangers and supports for standpipe system piping according to NFPA 14. Comply with requirements in NFPA 13 for hanger materials.

I. Install pressure gages on riser or feed main and at top of each standpipe. Include pressure gages with connection not less than NPS 1/4 (DN 8) and with soft-metal seated globe valve, arranged for draining pipe between gage and valve. Install gages to permit removal and install where they are not subject to freezing.

J. Fill standpipe system piping with water.

K. Install electric heating cables and pipe insulation on wet-type fire-suppression standpipe piping in areas subject to freezing. Comply with requirements for heating cables in Section 210533 "Heat Tracing for Fire-Suppression Piping" and for piping insulation in Section 210700 "Fire-Suppression Systems Insulation."

L. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 210517 "Sleeves and Sleeve Seals for Fire-Suppression Piping."

M. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 210517 "Sleeves and Sleeve Seals for Fire-Suppression Piping."

N. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 210518 "Escutcheons for Fire-Suppression Piping."

3.5 JOINT CONSTRUCTION

A. Install couplings, flanges, flanged fittings, unions, nipples, and transition and special fittings that have finish and pressure ratings same as or higher than system's pressure rating for aboveground applications unless otherwise indicated.

B. Install unions adjacent to each valve in pipes NPS 2 (DN 50) and smaller.

C. Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 (DN 65) and larger end connections.

D. Ream ends of pipes and tubes, and remove burrs. Bevel plain ends of steel pipe.

E. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.

F. Flanged Joints: Select appropriate gasket material in size, type, and thickness suitable for water service. Join flanges with gasket and bolts according to ASME B31.9.

G. Threaded Joints: Thread pipe with tapered pipe threads according to 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.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.

H. Steel-Piping, Cut-Grooved Joints: Cut square-edge groove in end of pipe according to AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join steel pipe and grooved-end fittings according to AWWA C606 for steel-pipe joints.

I. Steel-Piping, Roll-Grooved Joints: Roll rounded-edge groove in end of pipe according to AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join steel pipe and grooved-end fittings according to AWWA C606 for steel-pipe grooved joints.

J. Welded Joints: Construct joints according to AWS D10.12/D10.12M, using qualified processes and welding operators according to "Quality Assurance" Article.

1. Shop weld pipe joints where welded piping is indicated. Do not use welded joints for galvanized-steel pipe.

3.6 VALVE AND SPECIALTIES INSTALLATION

A. Install listed fire-protection valves, trim and drain valves, specialty valves and trim, controls, and specialties according to NFPA 14 and authorities having jurisdiction.

B. Install listed fire-protection shutoff valves supervised-open, located to control sources of water supply except from fire-department connections. Install permanent identification signs indicating portion of system controlled by each valve.

C. Install check valve in each water-supply connection. Install backflow preventers instead of check valves in potable-water-supply sources.

D. Specialty Valves:

1. General Requirements: Install in vertical position for proper direction of flow, in main supply to system.
2. Alarm Valves: Install bypass check valve and retarding chamber drain-line connection.

3.7 HOSE-CONNECTION INSTALLATION

A. Install hose connections adjacent to standpipes.

B. Install freestanding hose connections for access and minimum passage restriction.

C. Install NPS 1-1/2 (DN 40) hose-connection valves with flow-restricting device.

D. Install wall-mounted-type hose connections in cabinets. Include pipe escutcheons, with finish matching valves, inside cabinet where water-supply piping penetrates cabinet. Install valves at angle required for connection of fire hose. Comply with requirements for cabinets in Section 104413 "Fire Protection Cabinets."

3.8 HOSE-STATION INSTALLATION

A. Install freestanding hose stations for access and minimum passage restriction.

B. Install NPS 1-1/2 (DN 40) hose-station valves with flow-restricting device unless otherwise indicated.

C. Install freestanding hose stations with support or bracket attached to standpipe.

D. Install wall-mounted, rack hose stations in cabinets. Include pipe escutcheons, with finish matching valves, inside cabinet where water-supply piping penetrates cabinet. Install valves at angle required for connection of fire hose. Comply with requirements for cabinets in Section 104413 "Fire Protection Cabinets."

E. Install hose-reel hose stations on wall with bracket.

3.9 FIRE-DEPARTMENT CONNECTION INSTALLATION

A. Install wall-type fire-department connections.

B. Install yard-type fire-department connections in concrete slab support. Comply with requirements for concrete in Section 033000 "Cast-in-Place Concrete."

C. Install automatic (ball drip) drain valve at each check valve for fire-department connection.

3.10 IDENTIFICATION

A. Install labeling and pipe markers on equipment and piping according to requirements in NFPA 14.

B. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.11 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:

1. Leak Test: After installation, charge systems and test for leaks. Repair leaks and retest until no leaks exist.
2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
3. Flush, test, and inspect standpipe systems according to NFPA 14, "System Acceptance" Chapter.
4. Energize circuits to electrical equipment and devices.
5. Start and run air compressors.
6. Coordinate with fire-alarm tests. Operate as required.
7. Coordinate with fire-pump tests. Operate as required.
8. Verify that equipment hose threads are same as local fire-department equipment.

C. Fire-suppression standpipe system will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

3.12 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain specialty valves.

3.13 PIPING SCHEDULE

A. Piping between Fire-Department Connections and Check Valves: Galvanized, Schedule 40, steel pipe.

B. Wet-type fire-suppression standpipe piping shall be one of the following:

1. Schedule 40, black-steel pipe with threaded ends; uncoated, gray-iron threaded fittings; and threaded joints.
2. Schedule 40, black-steel pipe with cut- or roll-grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
3. Schedule 40, black-steel pipe with plain ends; steel welding fittings; and welded joints.
4.

END OF SECTION 211200

SECTION 211313
WET-PIPE SPRINKLER SYSTEMS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Pipes, fittings, and specialties.
2. Fire-protection valves.
3. Sprinklers.
4. Alarm devices.
5. Pressure gages.

B. Related Sections:

1. Section 211119 "Fire-Department Connections" for exposed-, flush-, and yard-type fire-department connections.
2. Section 211200 "Fire-Suppression Standpipes" for standpipe piping.

1.02 SYSTEM DESCRIPTIONS

A. Wet-Pipe Sprinkler System: Automatic sprinklers are attached to piping containing water and that is connected to water supply through alarm valve. Water discharges immediately from sprinklers when they are opened. Sprinklers open when heat melts fusible link or destroys frangible device. Hose connections are included if indicated.

1.03 PERFORMANCE REQUIREMENTS

A. Standard-Pressure Piping System Component: Listed for 175-psig (1200-kPa) minimum working pressure.

B. Delegated Design: Design sprinkler system(s), including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

1. Available fire-hydrant flow test records indicate the following conditions:

a. Date: 11/30/2023.
b. Time: 12:55 PM
c. Performed by: Columbus Division of Water.
d. Location of Residual Fire Hydrant R: 1st hydrant east of 1st alley W/O North Garfield Ave.
e. Location of Flow Fire Hydrant F: 1st hydrant west of 1st alley W/O North Garfield Ave.
f. Static Pressure at Residual Fire Hydrant R: 80 psi.
g. Measured Flow at Flow Fire Hydrant F: 1110 gpm.

h. Residual Pressure at Residual Fire Hydrant R: 60 psi.

C. Sprinkler system design shall be approved by authorities having jurisdiction.

1. Margin of Safety for Available Water Flow and Pressure: 10 percent, including losses through water-service piping, valves, and backflow preventers.
2. Sprinkler Occupancy Hazard Classifications:
   a. Building Service Areas: Ordinary Hazard, Group 1.
   b. Electrical Equipment Rooms: Ordinary Hazard, Group 1.
   c. General Storage Areas: Ordinary Hazard, Group 1.
   d. Mechanical Equipment Rooms: Ordinary Hazard, Group 1.
   e. Office and Public Areas: Light Hazard.
   f. Residential Living Areas: Light Hazard.

3. Minimum Density for Automatic-Sprinkler Piping Design:

   a. Residential (Dwelling) Occupancy: 0.05 gpm over 400-sq. ft. (2.04 mm/min. over 37.2-sq. m) area.
   b. Light-Hazard Occupancy: 0.10 gpm over 1500-sq. ft. (4.1 mm/min. over 139-sq. m) area.
   c. Ordinary-Hazard, Group 1 Occupancy: 0.15 gpm over 1500-sq. ft. (6.1 mm/min. over 139-sq. m) area.
   d. Special Occupancy Hazard: As determined by authorities having jurisdiction.

4. Total Combined Hose-Stream Demand Requirement: According to NFPA 13 unless otherwise indicated:

   a. Light-Hazard Occupancies: 100 gpm (6.3 L/s) for 30 minutes.
   b. Ordinary-Hazard Occupancies: 250 gpm (15.75 L/s) for 60 to 90 minutes.

1.04 SUBMITTALS

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

B. Shop Drawings: For wet-pipe sprinkler systems. Include plans, elevations, sections, details, and attachments to other work.

1. Wiring Diagrams: For power, signal, and control wiring.

C. Delegated-Design Submittal: For sprinkler 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.

D. Approved Sprinkler Piping Drawings: Working plans, prepared according to NFPA 13, that have been approved by authorities having jurisdiction, including hydraulic calculations if applicable.

E. Welding certificates.

F. Field Test Reports and Certificates: Indicate and interpret test results for compliance with performance requirements and as described in NFPA 13. Include "Contractor's Material and Test Certificate for Aboveground Piping."

G. Field quality-control reports.

H. Operation and maintenance data.

1.05 QUALITY ASSURANCE

A. Installer Qualifications:

1. Installer's responsibilities include designing, fabricating, and installing sprinkler systems and providing professional engineering services needed to assume engineering responsibility. Base calculations on results of fire-hydrant flow test.

a. Engineering Responsibility: Preparation of working plans, calculations, and field test reports by a qualified professional engineer.

B. Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

C. 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.

D. NFPA Standards: Sprinkler system equipment, specialties, accessories, installation, and testing shall comply with the following:

1. NFPA 13, "Installation of Sprinkler Systems."
2. NFPA 13R, "Installation of Sprinkler Systems in Residential Occupancies up to and Including Four Stories in Height."
3. NFPA 24, "Installation of Private Fire Service Mains and Their Appurtenances."

PART 2 - PRODUCTS

2.01 PIPING MATERIALS

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.

2.02 STEEL PIPE AND FITTINGS

A. Schedule 40 black steel pipe with class 125, cast-iron threaded fittings.

B. Schedule 10 black steel pipe with mechanical grooved pipe couplings (roll-grooved type).

2.03 CPVC PIPING

A. The pipe shall be rigid chlorinated polyvinyl chloride (CPVC), Type IV Grade I, with a Cell Classification of 23547 as defined in ASTM D1784. The product shall be orange in color, and approved by the National Sanitation Foundation (NSF) for use with potable water. Material shall be BlazeMaster CPVC material as provided by Noveon, Inc. (formerly the BF Goodrich Company). Fittings shall be UL Listed CPVC fittings and shall meet ASTM F437 (Sch 80 threaded), ASTM F437 (Sch 80 socket), or ASTM F438 (Sch 40 socket) as applicable, by Spears Manufacturing Co. or equivalent. Solvent cements shall be those referenced in Georg Fischer Harvel LLC Installation Instructions (such as Spears FS-5 or equivalent), which meet ASTM F656 and ASTM F493, and approved by the National Sanitation Foundation (NSF) for use with potable water. Socket type joints shall be made using the One-Step solvent cement joining method in accordance with GF Harvel Installation Instructions.

2.04 PIPING JOINING MATERIALS

A. Pipe-Flange Gasket Materials: AWWA C110, rubber, flat face, 1/8 inch (3.2 mm) thick or ASME B16.21, nonmetallic and asbestos free.

1. Class 125, Cast-Iron Flat-Face Flanges: Full-face gaskets.

B. Metal, Pipe-Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.

C. Welding Filler Metals: Comply with AWS D10.12M/D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

2.05 LISTED FIRE-PROTECTION VALVES

A. General Requirements:

1. Valves shall be UL listed or FM approved.
2. Minimum Pressure Rating: 175 psig (1200 kPa).

B. Check Valves:

1. Standard: UL 312.
2. Pressure Rating: 250 psig (1725 kPa) minimum.
3. Type: Swing check.
4. Body Material: Cast iron.
5. End Connections: Flanged or grooved.

C. Bronze OS&Y Gate Valves:

1. Standard: UL 262.
2. Pressure Rating: 175 psig (1200 kPa).
3. Body Material: Bronze.
4. End Connections: Threaded.

D. Iron OS&Y Gate Valves:

1. Standard: UL 262.
2. Pressure Rating: [250 psig (1725 kPa) minimum] [300 psig (2070 kPa)].
3. Body Material: Cast or ductile iron.
4. End Connections: Flanged or grooved.

E. Indicating-Type Butterfly Valves:

1. Standard: UL 1091.
2. Pressure Rating: 175 psig (1200 kPa) minimum.
3. Valves NPS 2 (DN 50) and Smaller:

    a. Valve Type: Ball or butterfly.
    b. Body Material: Bronze.
    c. End Connections: Threaded.

4. Valves NPS 2-1/2 (DN 65) and Larger:

    a. Valve Type: Butterfly.
    b. Body Material: Cast or ductile iron.
    c. End Connections: Flanged, grooved, or wafer.

2.06 TRIM AND DRAIN VALVES

A. General Requirements:

1. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
2. Minimum Pressure Rating: 175 psig (1200 kPa).

2.07 SPECIALTY VALVES

A. General Requirements:

1. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
2. Minimum Pressure Rating: 175 psig (1200 kPa).
3. Body Material: Cast or ductile iron.
4. Size: Same as connected piping.
5. End Connections: Flanged or grooved.

B. Alarm Valves:

1. Standard: UL 193.
2. Design: For horizontal or vertical installation.
3. Include trim sets for bypass, drain, electrical sprinkler alarm switch, pressure gages, and fill-line attachment with strainer.
4. Drip Cup Assembly: Pipe drain without valves and separate from main drain piping.
5. Drip Cup Assembly: Pipe drain with check valve to main drain piping.

C. Automatic (Ball Drip) Drain Valves:

1. Standard: UL 1726.
2. Pressure Rating: 175 psig (1200 kPa) minimum.
3. Type: Automatic draining, ball check.
4. Size: NPS 3/4 (DN 20).
5. End Connections: Threaded.

2.08 SPRINKLER SPECIALTY PIPE FITTINGS

A. Branch Outlet Fittings:

1. Standard: UL 213.
2. Pressure Rating: 175 psig (1200 kPa) minimum.
3. Body Material: Ductile-iron housing with EPDM seals and bolts and nuts.
4. Type: Mechanical-T and -cross fittings.
5. Configurations: Snap-on and strapless, ductile-iron housing with branch outlets.
6. Size: Of dimension to fit onto sprinkler main and with outlet connections as required to match connected branch piping.
7. Branch Outlets: Grooved, plain-end pipe, or threaded.

B. Flow Detection and Test Assemblies:

1. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
2. Pressure Rating: 175 psig (1200 kPa) minimum.
3. Body Material: Cast- or ductile-iron housing with orifice, sight glass, and integral test valve.
4. Size: Same as connected piping.
5. Inlet and Outlet: Threaded.

C. Branch Line Testers:

1. Standard: UL 199.
2. Pressure Rating: 175 psig (1200 kPa) minimum.
3. Body Material: Brass.
4. Size: Same as connected piping.
5. Inlet: Threaded.
6. Drain Outlet: Threaded and capped.
7. Branch Outlet: Threaded, for sprinkler.

D. Sprinkler Inspector's Test Fittings:

1. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
2. Pressure Rating: 175 psig (1200 kPa) minimum.
3. Body Material: Cast- or ductile-iron housing with sight glass.
4. Size: Same as connected piping.
5. Inlet and Outlet: Threaded.

E. Adjustable Drop Nipples:

1. Standard: UL 1474.
2. Pressure Rating: 250 psig (1725 kPa) minimum.
3. Body Material: Steel pipe with EPDM-rubber O-ring seals.
4. Size: Same as connected piping.
5. Length: Adjustable.
6. Inlet and Outlet: Threaded.

F. Flexible, Sprinkler Hose Fittings:

1. Standard: UL 1474.
2. Type: Flexible hose for connection to sprinkler, and with bracket for connection to ceiling grid.
3. Pressure Rating: 175 psig (1200 kPa) minimum.
4. Size: Same as connected piping, for sprinkler.

2.09 SPRINKLERS

A. General Requirements:

1. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
2. Pressure Rating for Residential Sprinklers: 175 psig (1200 kPa) maximum.
3. Pressure Rating for Automatic Sprinklers: 175 psig (1200 kPa) minimum.

B. Automatic Sprinklers with Heat-Responsive Element:

1. Early-Suppression, Fast-Response Applications: UL 1767.
2. Nonresidential Applications: UL 199.
3. Residential Applications: UL 1626.
4. Characteristics: Nominal 1/2-inch (12.7-mm) orifice with Discharge Coefficient K of 5.6, and for "Ordinary" temperature classification rating unless otherwise indicated or required by application.

C. Sprinkler Finishes:

1. Chrome plated.
2. Bronze.
3. Painted.

D. Sprinkler Escutcheons: Materials, types, and finishes for the following sprinkler mounting applications. Escutcheons for concealed, flush, and recessed-type sprinklers are specified with sprinklers.

1. Ceiling Mounting: Chrome-plated steel, one piece, flat.
2. Sidewall Mounting: Chrome-plated steel, one piece, flat.

E. Sprinkler Guards:

1. Standard: UL 199.
2. Type: Wire cage with fastening device for attaching to sprinkler.

2.10 ALARM DEVICES

A. Alarm-device types shall match piping and equipment connections.

B. Water-Motor-Operated Alarm:

1. Standard: UL 753.
2. Type: Mechanically operated, with Pelton wheel.
3. Alarm Gong: Cast aluminum with red-enamel factory finish.
4. Size: 10-inch (250-mm) diameter.
5. Components: Shaft length, bearings, and sleeve to suit wall construction.
6. Inlet: NPS 3/4 (DN 20).
7. Outlet: NPS 1 (DN 25) drain connection.

C. Water-Flow Indicators:

1. Standard: UL 346.
2. Water-Flow Detector: Electrically supervised.
3. Components: Two single-pole, double-throw circuit switches for isolated alarm and auxiliary contacts, 7 A, 125-V ac and 0.25 A, 24-V dc; complete with factory-set, field-adjustable retard element to prevent false signals and tamperproof cover that sends signal if removed.
4. Type: Paddle operated.
5. Pressure Rating: 250 psig (1725 kPa).
6. Design Installation: Horizontal or vertical.

D. Valve Supervisory Switches:

1. Standard: UL 346.
2. Type: Electrically supervised.
3. Components: Single-pole, double-throw switch with normally closed contacts.
4. Design: Signals that controlled valve is in other than fully open position.

2.11 PRESSURE GAGES

A. Standard: UL 393.

B. Dial Size: 3-1/2- to 4-1/2-inch (90- to 115-mm) diameter.

C. Pressure Gage Range: 0 to 250 psig (0 to 1725 kPa) minimum.

D. Water System Piping Gage: Include "WATER" or "AIR/WATER" label on dial face.

E. Air System Piping Gage: Include "AIR" or "AIR/WATER" label on dial face.

PART 3 - EXECUTION

3.01 SERVICE-ENTRANCE PIPING

A. Connect sprinkler piping to water-service piping for service entrance to building. Comply with requirements for exterior piping in Section 211100 "Facility Fire-Suppression Water-Service Piping."

B. Install shutoff valve, backflow preventer, pressure gage, drain, and other accessories indicated at connection to water-service piping.

C. Install shutoff valve, check valve, pressure gage, and drain at connection to water service.

3.02 WATER-SUPPLY CONNECTIONS

A. Connect sprinkler piping to building's interior water-distribution piping. Comply with requirements for interior piping in Section 221116 "Domestic Water Piping."

B. Install shutoff valve, backflow preventer, pressure gage, drain, and other accessories indicated at connection to water-distribution piping.

C. Install shutoff valve, check valve, pressure gage, and drain at connection to water supply.

3.03 PIPING INSTALLATION

A. Locations and Arrangements: Drawing plans, schematics, and diagrams indicate general location and arrangement of piping. Install piping as indicated, as far as practical.

1. Deviations from approved working plans for piping require written approval from authorities having jurisdiction. File written approval with Architect before deviating from approved working plans.

B. Piping Standard: Comply with requirements for installation of sprinkler piping in NFPA 13.

C. Install seismic restraints on piping. Comply with requirements for seismic-restraint device materials and installation in NFPA 13.

D. Use listed fittings to make changes in direction, branch takeoffs from mains, and reductions in pipe sizes.

E. Install unions adjacent to each valve in pipes NPS 2 (DN 50) and smaller.

F. Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 (DN 65) and larger end connections.

G. Install "Inspector's Test Connections" in sprinkler system piping, complete with shutoff valve, and sized and located according to NFPA 13.

H. Install sprinkler piping with drains for complete system drainage.

I. Install sprinkler control valves, test assemblies, and drain risers adjacent to standpipes when sprinkler piping is connected to standpipes.

J. Install automatic (ball drip) drain valve at each check valve for fire-department connection, to drain piping between fire-department connection and check valve. Install drain piping to and spill over floor drain or to outside building.

K. Install alarm devices in piping systems.

L. Install hangers and supports for sprinkler system piping according to NFPA 13. Comply with requirements for hanger materials in NFPA 13.

M. Install pressure gages on riser or feed main, at each sprinkler test connection, and at top of each standpipe. Include pressure gages with connection not less than NPS 1/4 (DN 8) and with soft metal seated globe valve, arranged for draining pipe between gage and valve. Install gages to permit removal, and install where they will not be subject to freezing.

N. Fill sprinkler system piping with water.

O. Install electric heating cables and pipe insulation on sprinkler piping in areas subject to freezing. Comply with requirements for heating cables in Section 210533 "Heat Tracing for Fire-Suppression Piping" and for piping insulation in Section 210700 "Fire-Suppression Systems Insulation."

P. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 210517 "Sleeves and Sleeve Seals for Fire-Suppression Piping."

Q. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 210517 "Sleeves and Sleeve Seals for Fire-Suppression Piping."

R. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 210518 "Escutcheons for Fire-Suppression Piping."

3.04 JOINT CONSTRUCTION

A. Install couplings, flanges, flanged fittings, unions, nipples, and transition and special fittings that have finish and pressure ratings same as or higher than system's pressure rating for aboveground applications unless otherwise indicated.

B. Install unions adjacent to each valve in pipes NPS 2 (DN 50) and smaller.

C. Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 (DN 65) and larger end connections.

D. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

E. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.

F. Flanged Joints: Select appropriate gasket material in size, type, and thickness suitable for water service. Join flanges with gasket and bolts according to ASME B31.9.

G. Threaded Joints: Thread pipe with tapered pipe threads according to 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.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.

H. Twist-Locked Joints: Insert plain end of steel pipe into plain-end-pipe fitting. Rotate retainer lugs one-quarter turn or tighten retainer pin.

I. Steel-Piping, Pressure-Sealed Joints: Join lightwall steel pipe and steel pressure-seal fittings with tools recommended by fitting manufacturer.

J. Welded Joints: Construct joints according to AWS D10.12M/D10.12, using qualified processes and welding operators according to "Quality Assurance" Article.

1. Shop weld pipe joints where welded piping is indicated. Do not use welded joints for galvanized-steel pipe.

K. Steel-Piping, Cut-Grooved Joints: Cut square-edge groove in end of pipe according to AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join steel pipe and grooved-end fittings according to AWWA C606 for steel-pipe joints.

L. Steel-Piping, Roll-Grooved Joints: Roll rounded-edge groove in end of pipe according to AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join steel pipe and grooved-end fittings according to AWWA C606 for steel-pipe grooved joints.

M. Steel-Piping, Pressure-Sealed Joints: Join Schedule 5 steel pipe and steel pressure-seal fittings with tools recommended by fitting manufacturer.

N. Dissimilar-Material Piping Joints: Make joints using adapters compatible with materials of both piping systems.

3.05 VALVE AND SPECIALTIES INSTALLATION

A. Install listed fire-protection valves, trim and drain valves, specialty valves and trim, controls, and specialties according to NFPA 13 and authorities having jurisdiction.

B. Install listed fire-protection shutoff valves supervised open, located to control sources of water supply except from fire-department connections. Install permanent identification signs indicating portion of system controlled by each valve.

C. Install check valve in each water-supply connection. Install backflow preventers instead of check valves in potable-water-supply sources.

D. Specialty Valves:

1. General Requirements: Install in vertical position for proper direction of flow, in main supply to system.
2. Alarm Valves: Include bypass check valve and retarding chamber drain-line connection.

3.06 SPRINKLER INSTALLATION

A. Install sprinklers in suspended ceilings in center of acoustical ceiling panels (in at least one direction).

B. Install dry-type sprinklers with water supply from heated space. Do not install pendent or sidewall, wet-type sprinklers in areas subject to freezing.

C. Install sprinklers into flexible, sprinkler hose fittings and install hose into bracket on ceiling grid.

3.07 IDENTIFICATION

A. Install labeling and pipe markers on equipment and piping according to requirements in NFPA 13.

B. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.08 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:

1. Leak Test: After installation, charge systems and test for leaks. Repair leaks and retest until no leaks exist.
2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
3. Flush, test, and inspect sprinkler systems according to NFPA 13, "Systems Acceptance" Chapter.
4. Energize circuits to electrical equipment and devices.
5. Coordinate with fire-alarm tests. Operate as required.
6. Coordinate with fire-pump tests. Operate as required.
7. Verify that equipment hose threads are same as local fire-department equipment.

C. Sprinkler piping system will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

3.09 CLEANING

A. Clean dirt and debris from sprinklers.

B. Remove and replace sprinklers with paint other than factory finish.

3.10 PIPING SCHEDULE

A. Piping between Fire-Department Connections and Check Valves: Galvanized, standard-weight steel pipe.

B. Where allowed by code, piping can be CPVC.

C. Where CPVC piping is not allowed, piping shall be black steel pipe.

END OF SECTION 211313

SECTION 220516

EXPANSION FITTINGS AND LOOPS FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Packless expansion joints.
2. Grooved-joint expansion joints.
3. Pipe loops and swing connections.
4. Alignment guides and anchors.

1.2 ACTION SUBMITTALS

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

1.3 INFORMATIONAL SUBMITTALS

A. Welding certificates.

B. Product certificates.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance data.

PART 2 - PRODUCTS

2.1 PACKLESS EXPANSION JOINTS

A. Packless Expansion Joints:
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. Flex-Hose Co., Inc.
   b. Flexicraft Industries.
   c. Flex Pression Ltd.
   d. Metraflex, Inc.
   e. Unisource Manufacturing, Inc.

2. Standards: ASTM F 1120 and EJMA's "Standards of the Expansion Joint Manufacturers Association, Inc."

2.2 GROOVED-JOINT EXPANSION JOINTS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. Anvil International, Inc.
2. Shurjoint Piping Products.
3. Victaulic Company.

B. Description: Factory-assembled expansion joint made of several grooved-end pipe nipples, couplings, and grooved joints.

C. Standard: AWWA C606, for grooved joints.

D. Nipples: ASTM A 53/A 53M, Schedule 40, Type E or S, steel pipe with grooved ends.

2.3 ALIGNMENT GUIDES AND ANCHORS

A. Alignment Guides:
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. Adsco Manufacturing LLC.
b. American BOA, Inc.
c. Badger Industries, Inc.
d. Expansion Joint Systems, Inc.
e. Flex-Hose Co., Inc.
f. Flexicraft Industries.
g. Flex Pression Ltd.
h. Flex-Weld, Inc.
i. Flo Fab inc.
j. Hyspan Precision Products, Inc.
k. Metraflex, Inc.
l. Proco Products, Inc.
m. Senior Flexonics Pathway.
n. Tozen Corporation.
o. Unaflex.
p. Unisource Manufacturing, Inc.
q. Universal Metal Hose; a subsidiary of Hyspan Precision Products, Inc.
r. U.S. Bellows, Inc.
s. WahlcoMetroflex.

PART 3 - EXECUTION

3.1 EXPANSION-JOINT INSTALLATION

A. Install expansion joints of sizes matching sizes of piping in which they are installed.

B. Install metal-bellows expansion joints according to EJMA's "Standards of the Expansion Joint Manufacturers Association, Inc."

3.2 PIPE LOOP AND SWING CONNECTION INSTALLATION

A. Install pipe loops cold-sprung in tension or compression as required to partly absorb tension or compression produced during anticipated change in temperature.

B. Connect risers and branch connections to mains with at least five pipe fittings including tee in main.

C. Connect risers and branch connections to terminal units with at least four pipe fittings including tee in riser.

D. Connect mains and branch connections to terminal units with at least four pipe fittings including tee in main.

3.3 ALIGNMENT-GUIDE AND ANCHOR INSTALLATION

A. Install alignment guides to guide expansion and to avoid end-loading and torsional stress.

B. Install one guide(s) on each side of pipe expansion fittings and loops. Install guides nearest to expansion joint not more than four pipe diameters from expansion joint.

C. Attach guides to pipe and secure guides to building structure.

D. Install anchors at locations to prevent stresses from exceeding those permitted by ASME B31.9 and to prevent transfer of loading and stresses to connected equipment.

E. Anchor Attachments:

1. Anchor Attachment to Black-Steel Pipe: Attach by welding. Comply with ASME B31.9 and ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."
2. Anchor Attachment to Galvanized-Steel Pipe: Attach with pipe hangers. Use MSS SP-69, Type 42, riser clamp welded to anchor.
3. Anchor Attachment to Copper Tubing: Attach with pipe hangers. Use MSS SP-69, Type 24, U-bolts bolted to anchor.

F. Fabricate and install steel anchors by welding steel shapes, plates, and bars. Comply with ASME B31.9 and AWS D1.1/D1.1M.

1. Anchor Attachment to Steel Structural Members: Attach by welding.
2. Anchor Attachment to Concrete Structural Members: Attach by fasteners. Follow fastener manufacturer's written instructions.

G. Use grout to form flat bearing surfaces for guides and anchors attached to concrete.

END OF SECTION 220516

SECTION 220517

SLEEVES AND SLEEVE SEALS FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Sleeves.
2. Sleeve-seal systems.
3. Grout.

1.2 ACTION SUBMITTALS

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

PART 2 - PRODUCTS

2.1 SLEEVES

A. Cast-Iron Wall Pipes: Cast or fabricated of cast or ductile iron and equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.

B. Galvanized-Steel Wall Pipes: ASTM A 53/A 53M, Schedule 40, with plain ends and welded steel collar; zinc coated.

C. Galvanized-Steel-Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, with plain ends.

D. PVC-Pipe Sleeves: ASTM D 1785, Schedule 40.

E. Galvanized-Steel-Sheet Sleeves: 0.0239-inch (0.6-mm) minimum thickness; round tube closed with welded longitudinal joint.

2.2 SLEEVE-SEAL SYSTEMS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. Advance Products & Systems, Inc.
2. CALPICO, Inc.

3. Metraflex Company (The).
4. Pipeline Seal and Insulator, Inc.
5. Proco Products, Inc.
6. Link-Seal Modular Seals

B. Description: Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.

1. Sealing Elements: EPDM-rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
2. Pressure Plates: Carbon steel.
3. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating, of length required to secure pressure plates to sealing elements.

2.3 GROUT

A. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.

B. Characteristics: Nonshrink; recommended for interior and exterior applications.

C. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 SLEEVE INSTALLATION

A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.

B. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide **1-inch (25-mm)** annular clear space between piping and concrete slabs and walls.

1. Sleeves are not required for core-drilled holes.

C. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.

1. Cut sleeves to length for mounting flush with both surfaces.

a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas **2 inches (50 mm)** above finished floor level.

2. Using grout, seal the space outside of sleeves in slabs and walls without sleeve-seal system.

D. Install sleeves for pipes passing through interior partitions.

1. Cut sleeves to length for mounting flush with both surfaces.
2. Install sleeves that are large enough to provide 1/4-inch (6.4-mm) annular clear space between sleeve and pipe or pipe insulation.
3. Seal annular space between sleeve and piping or piping insulation; use joint sealants appropriate for size, depth, and location of joint. Comply with requirements for sealants specified in Section 079200 "Joint Sealants."

E. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements for firestopping specified in Section 078413 "Penetration Firestopping."

3.2 SLEEVE-SEAL-SYSTEM INSTALLATION

A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at service piping entries into building.

B. Select type, size, and number of sealing elements required for piping material and size and for sleeve ID or hole size. Position piping in center of sleeve. Center piping in penetration, assemble sleeve-seal system components, and install in annular space between piping and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal.

3.3 SLEEVE AND SLEEVE-SEAL SCHEDULE

A. Use sleeves and sleeve seals for the following piping-penetration applications:

1. Exterior Concrete Walls above Grade:

    a. Galvanized-steel-pipe sleeves.

2. Exterior Concrete Walls below Grade:

    a. Cast-iron wall sleeves with sleeve-seal system] [Galvanized-steel wall sleeves with sleeve-seal system>.

        1) Select sleeve size to allow for 1-inch (25-mm) annular clear space between piping and sleeve for installing sleeve-seal system.

3. Concrete Slabs-on-Grade:

    a. Cast-iron wall sleeves with sleeve-seal system.

        1) Select sleeve size to allow for 1-inch (25-mm) annular clear space between piping and sleeve for installing sleeve-seal system.

4. Concrete Slabs and Interior Partitions above Grade:

a. Steel-pipe sleeves.

END OF SECTION 220517

SECTION 220518

ESCUTCHEONS FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Escutcheons.
2. Floor plates.

1.2 ACTION SUBMITTALS

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

PART 2 - PRODUCTS

2.1 ESCUTCHEONS

A. One-Piece, Cast-Brass Type: With polished, chrome-plated finish and setscrew fastener.

B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with chrome-plated finish and spring-clip fasteners.

C. One-Piece, Stamped-Steel Type: With chrome-plated finish and spring-clip fasteners.

2.2 FLOOR PLATES

A. One-Piece Floor Plates: Cast-iron flange with holes for fasteners.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install escutcheons for piping penetrations of walls, ceilings, and finished floors.

B. Install escutcheons with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.

1. Escutcheons for New Piping:

    a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
    b. Chrome-Plated Piping: One-piece, cast-brass type with polished, chrome-plated finish.
    c. Insulated Piping: One-piece, stamped-steel type.
    d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass type with polished, chrome-plated finish.
    e. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, stamped-steel type.
    f. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, cast-brass type with polished, chrome-plated finish.
    g. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, stamped-steel type.
    h. Bare Piping in Unfinished Service Spaces: One-piece, cast-brass type with rough-brass finish.
    i. Bare Piping in Unfinished Service Spaces: One-piece, stamped-steel type.
    j. Bare Piping in Equipment Rooms: One-piece, cast-brass type with rough-brass finish.
    k. Bare Piping in Equipment Rooms: One-piece, stamped-steel type.

C. Install floor plates for piping penetrations of equipment-room floors.

D. Install floor plates with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.

    1. New Piping: One-piece, floor-plate type.

3.2 FIELD QUALITY CONTROL

A. Replace broken and damaged escutcheons and floor plates using new materials.

END OF SECTION 220518

SECTION 220519

METERS AND GAGES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Bimetallic-actuated thermometers.
2. Liquid-in-glass thermometers.
3. Thermowells.
4. Dial-type pressure gages.
5. Gage attachments.

1.2 ACTION SUBMITTALS

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

1.3 INFORMATIONAL SUBMITTALS

A. Product certificates.

1.4 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

PART 2 - PRODUCTS

2.1 BIMETALLIC-ACTUATED THERMOMETERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Trerice, H. O. Co.
2. Ashcroft Inc.
3. Ernst Flow Industries.
4. Marsh Bellofram.
5. Miljoco Corporation.
6. Nanmac Corporation.

7. Noshok.
8. Palmer Wahl Instrumentation Group.
9. REOTEMP Instrument Corporation.
10. Tel-Tru Manufacturing Company.
11. Watts Regulator Co.; a div. of Watts Water Technologies, Inc.
12. Weiss Instruments, Inc.
13. WIKA Instrument Corporation - USA.
14. Winters Instruments - U.S.

B. Standard: ASME B40.200.

2.2 LIQUID-IN-GLASS THERMOMETERS

A. Metal-Case, Industrial-Style, Liquid-in-Glass Thermometers:
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. Trerice, H. O. Co.
   b. Ashcroft Inc.
   c. Ernst Flow Industries.
   d. Marsh Bellofram.
   e. Miljoco Corporation.
   f. Nanmac Corporation.
   g. Noshok.
   h. Palmer Wahl Instrumentation Group.
   i. REOTEMP Instrument Corporation.
   j. Tel-Tru Manufacturing Company.
   k. Watts Regulator Co.; a div. of Watts Water Technologies, Inc.
   l. Weiss Instruments, Inc.
   m. WIKA Instrument Corporation - USA.
   n. Winters Instruments - U.S.

2. Standard: ASME B40.200.
3. Case: Cast aluminum; 7-inch nominal size unless otherwise indicated.
4. Case Form: Back angle unless otherwise indicated.
5. Tube: Glass with magnifying lens and blue or red organic liquid.
6. Tube Background: Nonreflective aluminum with permanently etched scale markings graduated in deg F.
7. Window: Glass.
8. Stem: Aluminum and of length to suit installation.

   a. Design for Thermowell Installation: Bare stem.
9. Accuracy: Plus or minus 1 percent of scale range or one scale division, to a maximum of 1.5 percent of scale range.

2.3 THERMOWELLS

A. Thermowells:

1. Standard: ASME B40.200.
2. Description: Pressure-tight, socket-type fitting made for insertion into piping tee fitting.

B. Heat-Transfer Medium: Mixture of graphite and glycerin.

2.4 PRESSURE GAGES

A. Direct-Mounted, Metal-Case, Dial-Type Pressure Gages:
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. AMETEK, Inc.; U.S. Gauge.
   b. Ashcroft Inc.
   c. Ernst Flow Industries.
   d. Flo Fab Inc.
   e. Marsh Bellofram.
   f. Miljoco Corporation.
   g. Noshok.
   h. Palmer Wahl Instrumentation Group.
   i. REOTEMP Instrument Corporation.
   j. Tel-Tru Manufacturing Company.
   k. Trerice, H. O. Co.
   l. Watts Regulator Co.; a div. of Watts Water Technologies, Inc.
   m. Weiss Instruments, Inc.
   n. WIKA Instrument Corporation - USA.
   o. Winters Instruments - U.S.
2. Standard: ASME B40.100.
3. Case: Liquid-filled type; cast aluminum or drawn steel. 4-1/2-inch (114-mm) nominal diameter.
4. Pressure-Element Assembly: Bourdon tube unless otherwise indicated.
5. Pressure Connection: Brass, with NPS 1/4 (DN 8), ASME B1.20.1 pipe threads and bottom-outlet type unless back-outlet type is indicated.
6. Movement: Mechanical, with link to pressure element and connection to pointer.
7. Dial: Nonreflective aluminum with permanently etched scale markings graduated in psi.
8. Pointer: Dark-colored metal.
9. Window: Glass.
10. Ring: Metal.
11. Accuracy: Grade C, plus or minus 3 percent of middle half of scale range.

2.5 GAGE ATTACHMENTS

A. Snubbers: ASME B40.100, brass; with **NPS 1/4 (DN 8)**, ASME B1.20.1 pipe threads and surge-dampening device. Include extension for use on insulated piping.

B. Valves: **Brass ball**, with **NPS 1/4 (DN 8)**, ASME B1.20.1 pipe threads.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install thermowells with socket extending **one-third of pipe diameter** and in vertical position in piping tees.

B. Install thermowells of sizes required to match thermometer connectors. Include bushings if required to match sizes.

C. Install thermowells with extension on insulated piping.

D. Fill thermowells with heat-transfer medium.

E. Install direct-mounted thermometers in thermowells and adjust vertical and tilted positions.

F. Install remote-mounted thermometer bulbs in thermowells and install cases on panels; connect cases with tubing and support tubing to prevent kinks. Use minimum tubing length.

G. Install direct-mounted pressure gages in piping tees with pressure gage located on pipe at the most readable position.

H. Install remote-mounted pressure gages on panel.

I. Install valve and snubber in piping for each pressure gage for fluids.

J. Install thermometers in the following locations:

1. Inlet and outlet of each water heater or heat exchanger.
2. Inlet and outlet of each domestic hot-water storage tank.

K. Install pressure gages in the following locations:

1. Building water service entrance into building.
2. Inlet and outlet of each pressure-reducing valve.
3. Suction and discharge of each domestic water pump.

L. Install meters and gages adjacent to machines and equipment to allow service and maintenance of meters, gages, machines, and equipment.

M. Adjust faces of meters and gages to proper angle for best visibility.

END OF SECTION 220519

SECTION 220523.12

BALL VALVES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Brass ball valves.
2. Bronze ball valves.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of valve.

1. Certification that products comply with NSF 61 and NSF 372.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR VALVES

A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.

B. ASME Compliance:

1. ASME B1.20.1 for threads for threaded end valves.
2. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
3. ASME B16.18 for solder-joint connections.
4. ASME B31.9 for building services piping valves.

C. NSF Compliance: NSF 61 and NSF 372 for valve materials for potable-water service.

D. Valves in Insulated Piping:

1. Include 2-inch (50-mm) stem extensions.
2. Extended operating handles of nonthermal-conductive material and protective sleeves that allow operation of valves without breaking vapor seals or disturbing insulation.
3. Memory stops that are fully adjustable after insulation is applied.

2.2 BRONZE BALL VALVES

A. Two-Piece, Full-Port, Bronze Ball Valves with Bronze Trim:
   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. American Valve, Inc.
      b. Conbraco Industries, Inc.; Apollo Valves.
      c. Crane Co.; Crane Valve Group; Crane Valves.
      d. Hammond Valve.
      e. Lance Valves; a division of Advanced Thermal Systems, Inc.
      f. Legend Valve.
      g. Milwaukee Valve Company.
      h. NIBCO INC.
      i. Red-White Valve Corporation.
      j. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
   2. Description:
      a. Standard: MSS SP-110.
      b. CWP Rating: 600 psig.
      c. Body Design: Two piece.
      d. Body Material: Bronze.
      e. Seats: PTFE or TFE.
      f. Stem: Bronze.
      g. Ball: Chrome-plated brass.
      h. Port: Full.

PART 3 - EXECUTION

3.1 VALVE INSTALLATION

A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.

B. Locate valves for easy access and provide separate support where necessary.

C. Install valves in horizontal piping with stem at or above center of pipe.

D. Install valves in position to allow full stem movement.

END OF SECTION 220523.12

SECTION 220523.14
CHECK VALVES FOR PLUMBING PIPING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Bronze swing check valves.

1.02 ACTION SUBMITTALS

A. Product Data: For each type of valve.

1. Certification that products comply with NSF 6.

PART 2 - PRODUCTS

2.01 GENERAL REQUIREMENTS FOR VALVES

A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.

B. ASME Compliance:

1. ASME B1.20.1 for threads for threaded end valves.
2. ASME B16.1 for flanges on iron valves.
3. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
4. ASME B16.18 for solder joint.
5. ASME B31.9 for building services piping valves.

C. NSF Compliance: NSF 61for valve materials for potable-water service.

D. Bronze valves shall be made with dezincification-resistant materials. Bronze valves made with copper alloy (brass) containing more than 15 percent zinc are not permitted.

E. Valve Pressure-Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.

F. Valve Sizes: Same as upstream piping unless otherwise indicated.

G. Valve Bypass and Drain Connections: MSS SP-45.

2.02 BRONZE SWING CHECK VALVES

A. Class 125, Bronze Swing Check Valves with Bronze Disc:

1. Description:

a. Standard: MSS SP-80, Type 3.
b. CWP Rating: 200 psig.
c. Body Design: Horizontal flow.
d. Body Material: ASTM B 62, bronze.
e. Ends: Threaded or soldered. See valve schedule articles.
f. Disc: Bronze.

B. Class 125, Bronze Swing Check Valves with Nonmetallic Disc:

1. Description:

a. Standard: MSS SP-80, Type 4.
b. CWP Rating: 200 psig.
c. Body Design: Horizontal flow.
d. Body Material: ASTM B 62, bronze.
e. Ends: Threaded or soldered. See valve schedule articles.
f. Disc: PTFE.

PART 3 - EXECUTION

3.01 VALVE INSTALLATION

A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.

B. Locate valves for easy access and provide separate support where necessary.

C. Install valves in horizontal piping with stem at or above center of pipe.

D. Install valves in position to allow full stem movement.

E. Install swing check valves for proper direction of flow in horizontal position with hinge pin level.

3.02 ADJUSTING

A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

3.03 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

A. If valve applications are not indicated, use the following:

1. Pump-Discharge Check Valves:

a. NPS 2 and Smaller: Bronze swing check valves with bronze disc.
b. NPS 2-1/2 and Larger for Domestic Water: Iron swing check valves with lever and weight or spring.
c. NPS 2-1/2 and Larger for Sanitary Waste and Storm Drainage: Iron swing check valves with lever and weight or spring.

B. If valves with specified CWP ratings are unavailable, the same types of valves with higher CWP ratings may be substituted.

C. End Connections:

1. For Copper Tubing, NPS 2 and Smaller: Threaded or soldered.
2. For Copper Tubing, NPS 2-1/2 to NPS 4: Flanged or threaded.
3. For Copper Tubing, NPS 5 and Larger: Flanged.
4. For Steel Piping, NPS 2 and Smaller: Threaded.
5. For Steel Piping, NPS 2-1/2 to NPS 4 : Flanged or threaded.
6. For Steel Piping, NPS 5 and Larger: Flanged.

3.04 DOMESTIC HOT- AND COLD-WATER VALVE SCHEDULE

A. Pipe NPS 2 and Smaller: Bronze swing check valves, Class 125, bronze disc with soldered or threaded end connections.

END OF SECTION 220523.14

SECTION 220529

HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Metal pipe hangers and supports.
2. Trapeze pipe hangers.
3. Thermal-hanger shield inserts.
4. Fastener systems.
5. Pipe positioning systems.
6. Equipment supports.

1.2 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design trapeze pipe hangers and equipment supports, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Structural Performance: Hangers and supports for plumbing piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.

1. Design supports for multiple pipes capable of supporting combined weight of supported systems, system contents, and test water.
2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
3. Design seismic-restraint hangers and supports for piping and equipment.

1.3 ACTION SUBMITTALS

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

PART 2 - PRODUCTS

2.1 METAL PIPE HANGERS AND SUPPORTS

A. Carbon-Steel Pipe Hangers and Supports:

1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
2. Galvanized Metallic Coatings: Pregalvanized or hot dipped.
3. Nonmetallic Coatings: Plastic coating, jacket, or liner.
4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
5. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon or stainless steel.

B. Stainless-Steel Pipe Hangers and Supports:

1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
2. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
3. Hanger Rods: Continuous-thread rod, nuts, and washer made of stainless steel

C. Copper Pipe Hangers:

1. Description: MSS SP-58, Types 1 through 58, copper-coated-steel, factory-fabricated components.
2. Hanger Rods: Continuous-thread rod, nuts, and washer made of copper-coated steel or stainless steel.

2.2 TRAPEZE PIPE HANGERS

A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural carbon-steel shapes with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U-bolts.

2.3 THERMAL-HANGER SHIELD INSERTS

A. Insulation-Insert Material for Cold Piping: ASTM C 552, Type II cellular glass with 100-psig (688-kPa) or ASTM C 591, Type VI, Grade 1 polyisocyanurate with 125-psig (862-kPa) minimum compressive strength and vapor barrier.

B. Insulation-Insert Material for Hot Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate with 100-psig (688-kPa), ASTM C 552, Type II cellular glass with 100-psig (688-kPa), or ASTM C 591, Type VI, Grade 1 polyisocyanurate with 125-psig (862-kPa) minimum compressive strength.

C. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.

D. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.

E. Insert Length: Extend 2 inches (50 mm) beyond sheet metal shield for piping operating below ambient air temperature.

2.4 FASTENER SYSTEMS

A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

B. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated or stainless steel anchors, for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

2.5 PIPE POSITIONING SYSTEMS

A. Description: IAPMO PS 42, positioning system of metal brackets, clips, and straps for positioning piping in pipe spaces; for plumbing fixtures in commercial applications.

2.6 EQUIPMENT SUPPORTS

A. Description: Welded, shop- or field-fabricated equipment support made from structural carbon-steel shapes.

2.7 MISCELLANEOUS MATERIALS

A. Structural Steel: ASTM A 36/A 36M, carbon-steel plates, shapes, and bars; black and galvanized.

B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, non-shrink and nonmetallic grout; suitable for interior and exterior applications.

1. Properties: Non-staining, noncorrosive, and nongaseous.
2. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT INSTALLATION

A. Metal Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.

B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.

1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.

2. Field fabricate from ASTM A 36/A 36M, carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.

C. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.

D. Fastener System Installation:

1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches (100 mm) thick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.
2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

E. Pipe Positioning-System Installation: Install support devices to make rigid supply and waste piping connections to each plumbing fixture.

F. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.

G. Equipment Support Installation: Fabricate from welded-structural-steel shapes.

H. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

I. Install lateral bracing with pipe hangers and supports to prevent swaying.

J. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

K. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

L. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.

M. Insulated Piping:

1. Attach clamps and spacers to piping.

a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.

2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.

    a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 (DN 100) and larger if pipe is installed on rollers.

3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.

    a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 (DN 100) and larger if pipe is installed on rollers.

4. Shield Dimensions for Pipe: Not less than the following:

    a. NPS 1/4 to NPS 3-1/2 (DN 8 to DN 90): 12 inches (305 mm) long and 0.048 inch (1.22 mm) thick.
    b. NPS 4 (DN 100): 12 inches (305 mm) long and 0.06 inch (1.52 mm) thick.
    c. NPS 5 and NPS 6 (DN 125 and DN 150): 18 inches (457 mm) long and 0.06 inch (1.52 mm) thick.
    d. NPS 8 to NPS 14 (DN 200 to DN 350): 24 inches (610 mm) long and 0.075 inch (1.91 mm) thick.
    e. NPS 16 to NPS 24 (DN 400 to DN 600): 24 inches (610 mm) long and 0.105 inch (2.67 mm) thick.

5. Pipes NPS 8 (DN 200) and Larger: Include wood or reinforced calcium-silicate-insulation inserts of length at least as long as protective shield.
6. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.2 EQUIPMENT SUPPORTS

A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.

B. Grouting: Place grout under supports for equipment and make bearing surface smooth.

C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.3 METAL FABRICATIONS

A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.

B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.

C. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and 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. Finish welds at exposed connections so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

3.4 ADJUSTING

A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches (40 mm).

3.5 HANGER AND SUPPORT SCHEDULE

A. Comply with MSS SP-69 for pipe-hanger selections and applications that are not specified in piping system Sections.

B. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.

C. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.

D. Use thermal-hanger shield inserts for insulated piping and tubing.

E. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes NPS 1/2 to NPS 30 (DN 15 to DN 750).
2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of up to 1050 deg F (566 deg C), pipes NPS 4 to NPS 24 (DN 100 to DN 600), requiring up to 4 inches (100 mm) of insulation.
3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes NPS 3/4 to NPS 36 (DN 20 to DN 900), requiring clamp flexibility and up to 4 inches (100 mm) of insulation.
4. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8 (DN 15 to DN 200).
5. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30 (DN 15 to DN 750).

6. Pipe Saddle Supports (MSS Type 36): For support of pipes NPS 4 to NPS 36 (DN 100 to DN 900), with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate.
7. Pipe Stanchion Saddles (MSS Type 37): For support of pipes NPS 4 to NPS 36 (DN 100 to DN 900), with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate, and with U-bolt to retain pipe.
8. Single-Pipe Rolls (MSS Type 41): For suspension of pipes NPS 1 to NPS 30 (DN 25 to DN 750), from two rods if longitudinal movement caused by expansion and contraction might occur.
9. Complete Pipe Rolls (MSS Type 44): For support of pipes NPS 2 to NPS 42 (DN 50 to DN 1050) if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.

F. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24 (DN 24 to DN 600).
2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 (DN 20 to DN 600) if longer ends are required for riser clamps.

G. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches (150 mm) for heavy loads.
2. Steel Clevises (MSS Type 14): For 120 to 450 deg F (49 to 232 deg C) piping installations.

H. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction, to attach to top flange of structural shape.
3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
6. C-Clamps (MSS Type 23): For structural shapes.
7. Welded-Steel Brackets: For support of pipes from below, or for suspending from above by using clip and rod. Use one of the following for indicated loads:

    a. Light (MSS Type 31): 750 lb (340 kg).
    b. Medium (MSS Type 32): 1500 lb (680 kg).
    c. Heavy (MSS Type 33): 3000 lb (1360 kg).

8. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
9. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.

I. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.

J. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches (32 mm).
2. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41, roll hanger with springs.
3. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from base support.

K. Comply with MSS SP-69 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.

L. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.

M. Use pipe positioning systems in pipe spaces behind plumbing fixtures to support supply and waste piping for plumbing fixtures.

END OF SECTION 220529

SECTION 220548.13

VIBRATION CONTROLS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Elastomeric isolation pads.
2. Elastomeric isolation mounts.
3. Restrained elastomeric isolation mounts.
4. Open-spring isolators.
5. Housed-spring isolators.
6. Restrained-spring isolators.
7. Housed-restrained-spring isolators.
8. Pipe-riser resilient supports.
9. Resilient pipe guides.
10. Elastomeric hangers.
11. Spring hangers.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Delegated-Design Submittal: For each vibration isolation device.

1. Include design calculations for selecting vibration isolators.

PART 2 - PRODUCTS

2.1 ELASTOMERIC ISOLATION PADS

A. Elastomeric Isolation Pads: <Insert drawing designation>.

1. <Double click here to find, evaluate, and insert list of manufacturers and products.>

2. Fabrication: Single or multiple layers of sufficient durometer stiffness for uniform loading over pad area.
3. Size: Factory or field cut to match requirements of supported equipment.
4. Pad Material: Oil and water resistant with elastomeric properties.
5. Surface Pattern: [Smooth] [Ribbed] [Waffle] pattern.
6. Infused nonwoven cotton or synthetic fibers.

7. Load-bearing metal plates adhered to pads.

2.2 ELASTOMERIC ISOLATION MOUNTS

A. Double-Deflection, Elastomeric Isolation Mounts: <Insert drawing designation>.

1. <Double click here to find, evaluate, and insert list of manufacturers and products.>

2. Mounting Plates:

   a. Top Plate: Encapsulated steel load transfer top plates, factory drilled and threaded[with threaded studs or bolts].
   b. Baseplate: Encapsulated steel bottom plates with holes provided for anchoring to support structure.

3. Elastomeric Material: Molded, oil-resistant rubber, neoprene, or other elastomeric material.

2.3 RESTRAINED ELASTOMERIC ISOLATION MOUNTS

A. Restrained Elastomeric Isolation Mounts: <Insert drawing designation>.

1. <Double click here to find, evaluate, and insert list of manufacturers and products.>

2. Description: All-directional isolator with restraints containing two separate and opposing elastomeric elements that prevent central threaded element and attachment hardware from contacting the housing during normal operation.

   a. Housing: Cast-ductile iron or welded steel.
   b. Elastomeric Material: Molded, oil-resistant rubber, neoprene, or other elastomeric material.

2.4 OPEN-SPRING ISOLATORS

A. Freestanding, Laterally Stable, Open-Spring Isolators: <Insert drawing designation>.

1. <Double click here to find, evaluate, and insert list of manufacturers and products.>

2. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
3. Minimum Additional Travel: 50 percent of the required deflection at rated load.
4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.

6. Baseplates: Factory-drilled steel plate for bolting to structure with an elastomeric isolator pad attached to the underside. Baseplates shall limit floor load to 500 psig (3447 kPa).
7. Top Plate and Adjustment Bolt: Threaded top plate with adjustment bolt and cap screw to fasten and level equipment.

2.5 HOUSED-SPRING ISOLATORS

A. Freestanding, Laterally Stable, Open-Spring Isolators in Two-Part Telescoping Housing: <Insert drawing designation>.

1. <Double click here to find, evaluate, and insert list of manufacturers and products.>

2. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
3. Minimum Additional Travel: 50 percent of the required deflection at rated load.
4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
6. Two-Part Telescoping Housing: A steel top and bottom frame separated by an elastomeric material and enclosing the spring isolators.

    a. Drilled base housing for bolting to structure with an elastomeric isolator pad attached to the underside. Bases shall limit floor load to 500 psig (3447 kPa).
    b. Top housing with [attachment and leveling bolt] [threaded mounting holes and internal leveling device] [elastomeric pad].

2.6 RESTRAINED-SPRING ISOLATORS

A. Freestanding, Laterally Stable, Open-Spring Isolators with Vertical-Limit Stop Restraint: <Insert drawing designation>.

1. <Double click here to find, evaluate, and insert list of manufacturers and products.>

2. Housing: Steel housing with vertical-limit stops to prevent spring extension due to weight being removed.

    a. Base with holes for bolting to structure with an elastomeric isolator pad attached to the underside. Bases shall limit floor load to 500 psig (3447 kPa).
    b. Top plate with [threaded mounting holes] [elastomeric pad].
    c. Internal leveling bolt that acts as blocking during installation.

3. Restraint: Limit stop as required for equipment and authorities having jurisdiction.
4. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.

5. Minimum Additional Travel: 50 percent of the required deflection at rated load.
6. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
7. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.

2.7 HOUSED-RESTRAINED-SPRING ISOLATORS

A. Freestanding, Steel, Open-Spring Isolators with Vertical-Limit Stop Restraint in Two-Part Telescoping Housing: <Insert drawing designation>.

1. <Double click here to find, evaluate, and insert list of manufacturers and products.>

2. Two-Part Telescoping Housing: A steel top and bottom frame separated by an elastomeric material and enclosing the spring isolators. Housings are equipped with [adjustable] [non-adjustable] snubbers to limit vertical movement.

    a. Drilled base housing for bolting to structure with an elastomeric isolator pad attached to the underside. Bases shall limit floor load to 500 psig (3447 kPa).
    b. Threaded top housing with adjustment bolt and cap screw to fasten and level equipment.

3. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
4. Minimum Additional Travel: 50 percent of the required deflection at rated load.
5. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
6. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.

2.8 PIPE-RISER RESILIENT SUPPORT

A. Description: All-directional, acoustical pipe anchor consisting of two steel tubes separated by a minimum 1/2-inch- (13-mm-) thick neoprene <Insert drawing designation>.

1. Vertical-Limit Stops: Steel and neoprene vertical-limit stops arranged to prevent vertical travel in both directions.
2. Maximum Load Per Support: 500 psig (3.45 MPa)on isolation material providing equal isolation in all directions.

2.9 RESILIENT PIPE GUIDES

A. Description: Telescopic arrangement of two steel tubes or post and sleeve arrangement separated by a minimum 1/2-inch- (13-mm-) thick neoprene <Insert drawing designation>.

1. Factory-Set Height Guide with Shear Pin: Shear pin shall be removable and reinsertable to allow for selection of pipe movement. Guides shall be capable of motion to meet location requirements.

2.10 ELASTOMERIC HANGERS

A. Elastomeric Mount in a Steel Frame with Upper and Lower Steel Hanger Rods: <Insert drawing designation>.

1. <Double click here to find, evaluate, and insert list of manufacturers and products.>

2. Frame: Steel, fabricated with a connection for an upper threaded hanger rod and an opening on the underside to allow for a maximum of 30 degrees of angular lower hanger-rod misalignment without binding or reducing isolation efficiency.
3. Dampening Element: Molded, oil-resistant rubber, neoprene, or other elastomeric material with a projecting bushing for the underside opening preventing steel to steel contact.

2.11 SPRING HANGERS

A. Combination Coil-Spring and Elastomeric-Insert Hanger with Spring and Insert in Compression: <Insert drawing designation>.

1. <Double click here to find, evaluate, and insert list of manufacturers and products.>

2. Frame: Steel, fabricated for connection to threaded hanger rods and to allow for a maximum of 30 degrees of angular hanger-rod misalignment without binding or reducing isolation efficiency.
3. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
4. Minimum Additional Travel: 50 percent of the required deflection at rated load.
5. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
6. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
7. Elastomeric Element: Molded, oil-resistant rubber or neoprene. Steel-washer-reinforced cup to support spring and bushing projecting through bottom of frame.
8. Adjustable Vertical Stop: Steel washer with neoprene washer "up-stop" on lower threaded rod.
9. Self-centering hanger rod cap to ensure concentricity between hanger rod and support spring coil.

PART 3 - EXECUTION

3.1 VIBRATION CONTROL DEVICE INSTALLATION

A. Coordinate the location of embedded connection hardware with supported equipment attachment and mounting points and with requirements for concrete reinforcement and formwork specified in [Section 033000 "Cast-in-Place Concrete."] [Section 033053 "Miscellaneous Cast-in-Place Concrete."]

B. Installation of vibration isolators must not cause any change of position of equipment, piping, or ductwork resulting in stresses or misalignment.

END OF SECTION 220548.13

SECTION 220719

PLUMBING PIPING INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes insulating the following plumbing piping services:

1. Domestic cold-water piping.
2. Domestic hot-water piping
3. Domestic recirculating hot-water piping.
4. Roof drains and rainwater leaders.
5. Floor drains, traps, and sanitary drain piping receiving condensate.
6. Exposed sanitary drains, domestic water, domestic hot water, and stops for plumbing fixtures for people with disabilities.
7. Domestic water and sanitary waste piping where heat tracing is installed.
8. Supplies and drains for handicap-accessible lavatories and sinks.

1.2 ACTION SUBMITTALS

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

1.3 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.4 QUALITY ASSURANCE

A. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84 by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.

1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

B. Comply with the following applicable standards and other requirements specified for miscellaneous components:

1. Supply and Drain Protective Shielding Guards: ICC A117.1.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

A. Comply with requirements in "Piping Insulation Schedule, General," "Indoor Piping Insulation Schedule," "Outdoor, Aboveground Piping Insulation Schedule," and "Outdoor, Underground Piping Insulation Schedule" articles for where insulating materials shall be applied.

B. Products shall not contain asbestos, lead, mercury, or mercury compounds.

C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.

D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.

E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

F. Cellular Glass: Inorganic, incombustible, foamed or cellulated glass with annealed, rigid, hermetically sealed cells. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
   1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
      a. Pittsburgh Corning Corporation; Foamglas.
      b. Owens-Corning Fiberglass Corp.
      c. Knauf
      d. CertainTeed.
      e. Johns Manville.
   2. Block Insulation: ASTM C 552, Type I.
   3. Special-Shaped Insulation: ASTM C 552, Type III.
   4. Preformed Pipe Insulation without Jacket: Comply with ASTM C 552, Type II, Class 1.
   5. Preformed Pipe Insulation with Factory-Applied ASJ: Comply with ASTM C 552, Type II, Class 2.
   6. Factory fabricate shapes according to ASTM C 450 and ASTM C 585.

G. Flexible Elastomeric Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials.
   1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
      a. Aeroflex USA, Inc.; Aerocel.
      b. Armacell LLC; AP Armaflex.
      c. K-Flex USA; Insul-Lock, Insul-Tube, and K-FLEX LS.

2.2 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated.

B. Cellular-Glass Adhesive: Two-component, thermosetting urethane adhesive containing no flammable solvents, with a service temperature range of minus 100 to plus 200 deg F (minus 73 to plus 93 deg C).

1. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

C. Flexible Elastomeric and Polyolefin Adhesive: Comply with MIL-A-24179A, Type II, Class I.

1. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

D. PVC Jacket Adhesive: Compatible with PVC jacket.

1. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.3 MASTICS

A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.

1. For indoor applications, use mastics that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. Vapor-Barrier Mastic: Water based; suitable for indoor use on below-ambient services.

1. Water-Vapor Permeance: ASTM E 96/E 96M, Procedure B, 0.013 perm (0.009 metric perm) at 43-mil (1.09-mm) dry film thickness.
2. Service Temperature Range: Minus 20 to plus 180 deg F (Minus 29 to plus 82 deg C).
3. Solids Content: ASTM D 1644, 58 percent by volume and 70 percent by weight.

4. Color: White.

C. Breather Mastic: Water based; suitable for indoor and outdoor use on above-ambient services.

1. Water-Vapor Permeance: ASTM F 1249, 1.8 perms (1.2 metric perms) at 0.0625-inch (1.6-mm) dry film thickness.
2. Service Temperature Range: Minus 20 to plus 180 deg F (Minus 29 to plus 82 deg C).
3. Solids Content: 60 percent by volume and 66 percent by weight.
4. Color: White.

2.4 SEALANTS

A. Joint Sealants:

1. Joint Sealants: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
   a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76.
   b. Eagle Bridges - Marathon Industries; 405.
   c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-45.
   d. Mon-Eco Industries, Inc.; 44-05.
   e. Pittsburgh Corning Corporation; Pittseal 444.

2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Permanently flexible, elastomeric sealant.
4. Service Temperature Range: Minus 100 to plus 300 deg F (Minus 73 to plus 149 deg C).
5. Color: White or gray.
6. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
7. Sealants shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.5 FACTORY-APPLIED JACKETS

A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:

1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.
3. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.

2.6 FIELD-APPLIED JACKETS

A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.

B. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D 1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming. Thickness is indicated in field-applied jacket schedules.
   1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
      a. Johns Manville; Zeston.
      b. P.I.C. Plastics, Inc.; FG Series.
      c. Proto Corporation; LoSmoke.
      d. Speedline Corporation; SmokeSafe.
   2. Adhesive: As recommended by jacket material manufacturer.
   3. Color: White.
   4. Factory-fabricated fitting covers to match jacket if available; otherwise, field fabricate.
      a. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, unions, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories.

C. Metal Jacket:
   1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
      a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; Metal Jacketing Systems.
      b. ITW Insulation Systems; Aluminum and Stainless Steel Jacketing.
      c. RPR Products, Inc.; Insul-Mate.
   2. Aluminum Jacket: Comply with ASTM B 209, Alloy 3003, 3005, 3105, or 5005, Temper H-14.
      a. Sheet and roll stock ready for shop or field sizing.
      b. Finish and thickness are indicated in field-applied jacket schedules.
      c. Moisture Barrier for Indoor Applications: 1-mil-thick, heat-bonded polyethylene and kraft paper.
      d. Moisture Barrier for Outdoor Applications: 3-mil-thick, heat-bonded polyethylene and kraft paper.
      e. Factory-Fabricated Fitting Covers:
         1) Same material, finish, and thickness as jacket.
         2) Preformed 2-piece or gore, 45- and 90-degree, short- and long-radius elbows.
         3) Tee covers.
         4) Flange and union covers.
         5) End caps.
         6) Beveled collars.
         7) Valve covers.
         8) Field fabricate fitting covers only if factory-fabricated fitting covers are not available.

D. Underground Direct-Buried Jacket: 125-mil-thick vapor barrier and waterproofing membrane consisting of a rubberized bituminous resin reinforced with a woven-glass fiber or polyester scrim and laminated aluminum foil.
   1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
      a. Pittsburgh Corning Corporation; Pittwrap.
      b. Polyguard Products, Inc.; Insulrap No Torch 125.
      c. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; Metal Jacketing Systems.

2.7 TAPES

A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.

   1. Width: 3 inches (75 mm).
   2. Thickness: 11.5 mils (0.29 mm).
   3. Adhesion: 90 ounces force/inch (1.0 N/mm) in width.
   4. Elongation: 2 percent.
   5. Tensile Strength: 40 lbf/inch (7.2 N/mm) in width.
   6. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

B. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136.

   1. Width: 3 inches (75 mm).
   2. Thickness: 6.5 mils (0.16 mm).
   3. Adhesion: 90 ounces force/inch (1.0 N/mm) in width.
   4. Elongation: 2 percent.
   5. Tensile Strength: 40 lbf/inch (7.2 N/mm) in width.
   6. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.

C. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive; suitable for indoor and outdoor applications.

   1. Width: 2 inches (50 mm).
   2. Thickness: 6 mils (0.15 mm).
   3. Adhesion: 64 ounces force/inch (0.7 N/mm) in width.
   4. Elongation: 500 percent.
   5. Tensile Strength: 18 lbf/inch (3.3 N/mm) in width.

D. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.
   1. Thickness: 3.7 mils (0.093 mm).
   2. Adhesion: 100 ounces force/inch (1.1 N/mm) in width.
   3. Elongation: 5 percent.
   4. Tensile Strength: 34 lbf/inch (6.2 N/mm) in width.

2.8 SECUREMENTS

A. Aluminum Bands: ASTM B 209 (ASTM B 209M), Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch (0.51 mm) thick, 1/2 inch (13 mm) wide with wing seal or closed seal.

B. Staples: Outward-clinching insulation staples, nominal 3/4-inch- (19-mm-) wide, stainless steel or Monel.

C. Wire: 0.080-inch (2.0-mm) nickel-copper alloy.

PART 3 - EXECUTION

3.1 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

B. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.

C. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

3.2 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping including fittings, valves, and specialties.

B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of pipe system as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.

G. Keep insulation materials dry during application and finishing.

H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

I. Install insulation with least number of joints practical.

J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.

1. Install insulation continuously through hangers and around anchor attachments.
2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.

K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

L. Install insulation with factory-applied jackets as follows:

1. Draw jacket tight and smooth.
2. Cover circumferential joints with 3-inch- (75-mm-) wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches (100 mm) o.c.
3. Overlap jacket longitudinal seams at least 1-1/2 inches (38 mm). Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches (50 mm) o.c.

    a. For below-ambient services, apply vapor-barrier mastic over staples.

4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.

M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches (100 mm) beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

P. For above-ambient services, do not install insulation to the following:

1. Vibration-control devices.

2. Testing agency labels and stamps.
3. Nameplates and data plates.
4. Cleanouts.

3.3 PENETRATIONS

A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches (50 mm) below top of roof flashing.
4. Seal jacket to roof flashing with flashing sealant.

B. Insulation Installation at Underground Exterior Wall Penetrations: Terminate insulation flush with sleeve seal. Seal terminations with flashing sealant.

C. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches (50 mm).
4. Seal jacket to wall flashing with flashing sealant.

D. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

E. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.

1. Comply with requirements in Section 078413 "Penetration Firestopping" for firestopping and fire-resistive joint sealers.

F. Insulation Installation at Floor Penetrations:

1. Pipe: Install insulation continuously through floor penetrations.
2. Seal penetrations through fire-rated assemblies. Comply with requirements in Section 078413 "Penetration Firestopping."

3.4 GENERAL PIPE INSULATION INSTALLATION

A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.

B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:

1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.
2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below-ambient services, provide a design that maintains vapor barrier.
6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below-ambient services and a breather mastic for above-ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
8. For services not specified to receive a field-applied jacket except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.
9. Stencil or label the outside insulation jacket of each union with the word "union." Match size and color of pipe labels.

C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes. Shape insulation at these connections by tapering it to and around the

connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.

D. Install removable insulation covers at locations indicated. Installation shall conform to the following:

1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.
2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.
3. Construct removable valve insulation covers in same manner as for flanges, except divide the two-part section on the vertical center line of valve body.
4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches (50 mm) over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.
5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

3.5 INSTALLATION OF CELLULAR-GLASS INSULATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with factory-applied jackets on above-ambient services, secure laps with outward clinched staples at 6 inches (150 mm) o.c.
4. For insulation with factory-applied jackets on below-ambient services, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of cellular-glass block insulation of same thickness as pipe insulation.

4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch (25 mm), and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.
2. When preformed sections of insulation are not available, install mitered sections of cellular-glass insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of cellular-glass insulation to valve body.
2. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.

3.6 INSTALLATION OF FLEXIBLE ELASTOMERIC INSULATION

A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

B. Insulation Installation on Pipe Flanges:

1. Install pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as pipe insulation.
4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install mitered sections of pipe insulation.
2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed valve covers manufactured of same material as pipe insulation when available.
2. When preformed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.

4. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.7 FIELD-APPLIED JACKET INSTALLATION

A. Where FSK jackets are indicated, install as follows:

1. Draw jacket material smooth and tight.
2. Install lap or joint strips with same material as jacket.
3. Secure jacket to insulation with manufacturer's recommended adhesive.
4. Install jacket with 1-1/2-inch (38-mm) laps at longitudinal seams and 3-inch- (75-mm-) wide joint strips at end joints.
5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-barrier mastic.

B. Where PVC jackets are indicated, install with 1-inch (25-mm) overlap at longitudinal seams and end joints. Seal with manufacturer's recommended adhesive.

1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.

C. Where metal jackets are indicated, install with 2-inch (50-mm) overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches (300 mm) o.c. and at end joints.

3.8 FINISHES

A. Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."

B. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.

C. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.

D. Do not field paint aluminum or stainless-steel jackets.

3.9 PIPING INSULATION SCHEDULE, GENERAL

A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.

B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:

1. Drainage piping located in crawl spaces.
2. Underground piping.
3. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

3.10 INDOOR PIPING INSULATION SCHEDULE

A. Domestic Cold-Water:

1. Cellular Glass: 1 inch (25 mm) thick.
2. Flexible Elastomeric: 1/2 inch (13 mm) thick.
3. Insulation thicknesses shall be doubled for piping installed in non-conditioned spaces such as boiler rooms, attics, crawl spaces, tunnels, etc.

B. Domestic Hot-Water:

1. Cellular Glass: 1-1/2 inches (38 mm) thick.
2. Flexible Elastomeric: 1 inch (25 mm) thick.
3. Insulation thicknesses shall be doubled for piping installed in non-conditioned spaces such as boiler rooms, attics, crawl spaces, tunnels, etc.

C. Domestic Recirculating Hot-Water:

1. Cellular Glass: 1-1/2 inches (38 mm) thick.
2. Flexible Elastomeric: 1 inch (25 mm) thick.
3. Insulation thicknesses shall be doubled for piping installed in non-conditioned spaces such as boiler rooms, attics, crawl spaces, tunnels, etc.

D. Roof Drains and Rainwater Leaders (Primary and Secondary):

1. Insulate the roof drain sump, the vertical piping drop from the roof drain, and all horizontal piping.
2. Cellular Glass: 1 inch (25 mm) thick.
3. Flexible Elastomeric: 1/2 inch (13 mm) thick.
4. Insulation thicknesses shall be doubled for piping installed in non-conditioned spaces such as boiler rooms, attics, crawl spaces, tunnels, etc.

E. Floor Drains, Traps, and Sanitary Drain Piping within 15 Feet of any Drain that can receive Condensate:

1. Cellular Glass: 1 inch (25 mm) thick.
2. Flexible Elastomeric: 1/2 inch (13 mm) thick.
3. Insulation thicknesses shall be doubled for piping installed in non-conditioned spaces such as boiler rooms, attics, crawl spaces, tunnels, etc.

F. Exposed Sanitary Drains, Domestic Water, Domestic Hot Water, and Stops for Plumbing Fixtures for People with Disabilities:

1. One-piece PVC, with 1/8” thickness, meeting the standards of ASTM E 84-07 with a flame spread/ 450 smoke index per the building code. Surfaces to be soft, smooth, non-absorbent, easy to clean U/V inhibited, antimicrobial, antifungal properties. Insulator shall have a dual fastening system which consists of fusion bonded Velcro fastener strips for full slit enclosure and tamper resistant, smooth, non-abrasive snap-locking fasteners. P-Trap Insulator: Shall have a one-piece design with a universal fit for 1 1/4"-1 1/2" brass or plastic traps, a longer neck area (for longer tailpieces) and a more forgiving girth area (for bulkier plastic DWV Schedule #40 plastic P-Traps w/swivel nut) and shall have drainage at lowest point to prevent condensation and/or leakage build up. Valve and Supply Insulator: Shall have a one-piece design with a universal fit over valve handles and brass, plastic or metal braided supplies and connectors and shall be able to flexcurl to a minimum of 360 degrees with a full slit closure for total compliance. Off-Set Insulator: Shall have a one-piece design with a universal fit and shall fit inside of P-trap insulator tailpiece area.

2. Soft, resilient molded vinyl, with 1/8” minimum constant nominal wall thickness with internal ribs, UV resistant, which meets the requirements of ASTM D-635 burning characteristics.

G. Domestic Water and Sanitary Waste Piping where Heat Tracing is Installed:

1. Coordinate insulation thickness according to the piping system, piping material, fluid being conveyed, and wattage of heat trace being provided as recommended by the heat trace manufacturer.

END OF SECTION 220719

SECTION 221113

FACILITY WATER DISTRIBUTION PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes water-distribution piping and related components outside the building for **water service** main**s**.

B. Utility-furnished products include water meters that will be furnished to the site, ready for installation.

1.2 ACTION SUBMITTALS

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

B. Shop Drawings: Detail precast concrete vault assemblies and indicate dimensions, method of field assembly, and components.

1.3 INFORMATIONAL SUBMITTALS

A. Field quality-control test reports.

1.4 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.5 QUALITY ASSURANCE

A. Regulatory Requirements:

1. Comply with requirements of utility company supplying water. Include tapping of water mains and backflow prevention.
2. Comply with standards of authorities having jurisdiction for potable-water-service piping, including materials, installation, testing, and disinfection.
3. Comply with standards of authorities having jurisdiction for fire-suppression water-service piping, including materials, hose threads, installation, and testing.

B. Piping materials shall bear label, stamp, or other markings of specified testing agency.

C. Comply with ASTM F 645 for selection, design, and installation of thermoplastic water piping.

D. Comply with FMG's "Approval Guide" or UL's "Fire Protection Equipment Directory" for fire-service-main products.

E. NFPA Compliance: Comply with NFPA 24 for materials, installations, tests, flushing, and valve and hydrant supervision for fire-service-main piping for fire suppression.

F. NSF Compliance:

1. Comply with NSF 14 for plastic potable-water-service piping. **Include marking "NSF-pw" on piping.**
2. Comply with NSF 61 for materials for water-service piping and specialties for domestic water.

1.6 COORDINATION

A. Coordinate connection to water main with utility company.

PART 2 - PRODUCTS

2.1 PIPE AND FITTINGS

A. Soft Copper Tube: **ASTM B 88, Type K (ASTM B 88M, Type A) and ASTM B 88, Type L (ASTM B 88M, Type B)**, water tube, annealed temper.

1. Copper, Solder-Joint Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint pressure type. Furnish only wrought-copper fittings if indicated.

B. Hard Copper Tube: **ASTM B 88, Type K (ASTM B 88M, Type A) and ASTM B 88, Type L (ASTM B 88M, Type B)**, water tube, drawn temper.

1. Copper, Solder-Joint Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint pressure type. Furnish only wrought-copper fittings if indicated.

C. Mechanical-Joint, Ductile-Iron Pipe: AWWA C151, with mechanical-joint bell and plain spigot end unless grooved or flanged ends are indicated.

1. Mechanical-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.
2. Glands, Gaskets, and Bolts: AWWA C111, ductile- or gray-iron glands, rubber gaskets, and steel bolts.

D. Push-on-Joint, Ductile-Iron Pipe: AWWA C151, with push-on-joint bell and plain spigot end unless grooved or flanged ends are indicated.

1. Push-on-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.

2. Gaskets: AWWA C111, rubber.

E. Grooved-Joint, Ductile-Iron Pipe: AWWA C151, with cut, rounded-grooved ends.

1. Grooved-End, Ductile-Iron Pipe Appurtenances:

F. PE, Fire-Service Pipe: ASTM F 714, AWWA C906, or equivalent for PE water pipe; FMG approved, with minimum thickness equivalent to FMG

1. Molded PE Fittings: ASTM D 3350, PE resin, socket- or butt-fusion type, made to match PE pipe dimensions and class.

G. PVC, AWWA Pipe: AWWA C900, with bell end with gasket, and with spigot end.

1. Comply with UL 1285 for fire-service mains if indicated.
2. PVC Fabricated Fittings: AWWA C900, with bell-and-spigot or double-bell ends. Include elastomeric gasket in each bell.
3. PVC Molded Fittings: AWWA C907, Class 150, with bell-and-spigot or double-bell ends. Include elastomeric gasket in each bell.
4. 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.

5. 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.

2.2 JOINING MATERIALS

A. Refer to Section 330500 "Common Work Results for Utilities" for commonly used joining materials.

B. Brazing Filler Metals: AWS A5.8, BCuP Series.

C. Bonding Adhesive for Fiberglass Piping: As recommended by fiberglass piping manufacturer.

D. Plastic Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.

2.3 PIPING SPECIALTIES

A. Transition Fittings: Manufactured fitting or coupling same size as, with pressure rating at least equal to and ends compatible with, piping to be joined.

B. Tubular-Sleeve Pipe Couplings:

1. Description: Metal, bolted, sleeve-type, reducing or transition coupling, with center sleeve, gaskets, end rings, and bolt fasteners and with ends of same sizes as piping to be joined.

    a. Standard: AWWA C219.

2.4 GATE VALVES

A. AWWA, Cast-Iron Gate Valves:

1. Nonrising-Stem, Metal-Seated Gate Valves:

    a. Description: Gray- or ductile-iron body and bonnet; with cast-iron or bronze double-disc gate, bronze gate rings, bronze stem, and stem nut.

        1) Standard: AWWA C500.
        2) Minimum Pressure Rating: 200 psig (1380 kPa).
        3) End Connections: Mechanical joint.
        4) Interior Coating: Complying with AWWA C550.

2. Nonrising-Stem, Resilient-Seated Gate Valves:

    a. Description: Gray- or ductile-iron body and bonnet; with bronze or gray- or ductile-iron gate, resilient seats, bronze stem, and stem nut.

        1) Standard: AWWA C509.
        2) Minimum Pressure Rating: 200 psig (1380 kPa).
        3) End Connections: Mechanical joint.
        4) Interior Coating: Complying with AWWA C550.

3. Nonrising-Stem, High-Pressure, Resilient-Seated Gate Valves:

    a. Description: Ductile-iron body and bonnet; with bronze or ductile-iron gate, resilient seats, bronze stem, and stem nut.

        1) Standard: AWWA C509.
        2) Minimum Pressure Rating: 250 psig (1725 kPa).
        3) End Connections: Push on or mechanical joint.
        4) Interior Coating: Complying with AWWA C550.

4. OS&Y, Rising-Stem, Metal-Seated Gate Valves:

    a. Description: Cast- or ductile-iron body and bonnet, with cast-iron double disc, bronze disc and seat rings, and bronze stem.

        1) Standard: AWWA C500.
        2) Minimum Pressure Rating: 200 psig (1380 kPa).
        3) End Connections: Flanged.

5. OS&Y, Rising-Stem, Resilient-Seated Gate Valves:

a. Description: Cast- or ductile-iron body and bonnet, with bronze or gray- or ductile-iron gate, resilient seats, and bronze stem.

1) Standard: AWWA C509.
2) Minimum Pressure Rating: 200 psig (1380 kPa).
3) End Connections: Flanged.

B. UL/FMG, Cast-Iron Gate Valves:

1. UL/FMG, Nonrising-Stem Gate Valves:

a. Description: Iron body and bonnet with flange for indicator post, bronze seating material, and inside screw.

1) Standards: UL 262 and FMG approved.
2) Minimum Pressure Rating: 175 psig (1207 kPa).
3) End Connections: Flanged.

2. OS&Y, Rising-Stem Gate Valves:

a. Description: Iron body and bonnet and bronze seating material.

1) Standards: UL 262 and FMG approved.
2) Minimum Pressure Rating: 175 psig (1207 kPa).
3) End Connections: Flanged.

C. Bronze Gate Valves:

1. OS&Y, Rising-Stem Gate Valves:

a. Description: Bronze body and bonnet and bronze stem.

1) Standards: UL 262 and FMG approved.
2) Minimum Pressure Rating: 175 psig (1207 kPa).
3) End Connections: Threaded.

2. Nonrising-Stem Gate Valves:

a. Description: Class 125, Type 1, bronze with solid wedge, threaded ends, and malleable-iron handwheel.

1) Standard: MSS SP-80.

2.5 GATE VALVE ACCESSORIES AND SPECIALTIES

A. Tapping-Sleeve Assemblies:

1. Description: Sleeve and valve compatible with drilling machine.

a. Standard: MSS SP-60.

b. Tapping Sleeve: Cast- or ductile-iron or stainless-steel, two-piece bolted sleeve with flanged outlet for new branch connection. Include sleeve matching size and type of pipe material being tapped and with recessed flange for branch valve.
c. Valve: AWWA, cast-iron, nonrising-stem, [**metal**] [**resilient**]-seated gate valve with one raised face flange mating tapping-sleeve flange.

B. Valve Boxes: Comply with AWWA M44 for cast-iron valve boxes. Include top section, adjustable extension of length required for depth of burial of valve, plug with lettering "WATER," and bottom section with base that fits over valve and with a barrel approximately 5 inches (125 mm) in diameter.

1. Operating Wrenches: Steel, tee-handle with one pointed end, stem of length to operate deepest buried valve, and socket matching valve operating nut.

C. Indicator Posts: UL 789, FMG-approved, vertical-type, cast-iron body with operating wrench, extension rod, and adjustable cast-iron barrel of length required for depth of burial of valve.

2.6 CORPORATION VALVES AND CURB VALVES

A. Manufacturers:

B. Service-Saddle Assemblies: Comply with AWWA C800. Include saddle and valve compatible with tapping machine.

1. Service Saddle: Copper alloy with seal and AWWA C800, threaded outlet for corporation valve.
2. Corporation Valve: Bronze body and ground-key plug, with AWWA C800, threaded inlet and outlet matching service piping material.
3. Manifold: Copper fitting with two to four inlets as required, with ends matching corporation valves and outlet matching service piping material.

C. Curb Valves: Comply with AWWA C800. Include bronze body, ground-key plug or ball, and wide tee head, with inlet and outlet matching service piping material.

D. Service Boxes for Curb Valves: Similar to AWWA M44 requirements for cast-iron valve boxes. Include cast-iron telescoping top section of length required for depth of burial of valve, plug with lettering "WATER," and bottom section with base that fits over curb valve and with a barrel approximately 3 inches (75 mm) in diameter.

1. Shutoff Rods: Steel, tee-handle with one pointed end, stem of length to operate deepest buried valve, and slotted end matching curb valve.

2.7 WATER METERS

A. Water meters will be furnished by utility company.

B. Manufacturers:

C. Displacement-Type Water Meters:

1. Description: With bronze main case.

a. Standard: AWWA C700.

D. Compound-Type Water Meters:

1. Description:

a. Standard: AWWA C702.

2.8 BACKFLOW PREVENTERS

A. Reduced-Pressure-Principle Backflow Preventers:

1. Standard: **ASSE 1013**.
2. Operation: Continuous-pressure applications.
3. Size: 2”
4. Body: Bronze for NPS 2 (DN 50) and smaller; **cast iron with interior lining complying with AWWA C550 or that is FDA approved steel with interior lining complying with AWWA C550 or that is FDA approved stainless steel**] for NPS 2-1/2 (DN 65) and larger.
5. End Connections: Threaded for NPS 2 (DN 50) and smaller; for NPS 2-1/2 (DN 65) and larger.
6. Configuration: Designed for **horizontal, straight through , horizontal center section, and vertical outlet** flow.
7. Accessories:

a. Valves: Ball type with threaded ends on inlet and outlet of NPS 2 (DN 50) and smaller; OS&Y gate type with flanged ends on inlet and outlet of NPS 2-1/2 (DN 65) and larger.
b. Air-Gap Fitting: ASME A112.1.2, matching backflow preventer connection.

PART 3 - EXECUTION

3.1 EARTHWORK

A. Refer to Section 312000 "Earth Moving" for excavating, trenching, and backfilling.

3.2 PIPING APPLICATIONS

A. General: Use pipe, fittings, and joining methods for piping systems according to the following applications.

B. Transition couplings and special fittings with pressure ratings at least equal to piping pressure rating may be used, unless otherwise indicated.

C. Do not use flanges or unions for underground piping.

D. Flanges, unions, and special fittings may be used, instead of joints indicated, on aboveground piping and piping in vaults.

E. Underground water-service piping **NPS 3/4 to NPS 3 (DN 20 to DN 80)** shall be soft copper tube, **ASTM B 88, Type K (ASTM B 88M, Type A) ASTM B 88, Type L (ASTM B 88M, Type B)**; wrought-copper, solder-joint fittings; and brazed joints.

F. Underground water-service piping **NPS 4 and NPS 6 (DN 100 and DN 150)**] shall be **any of** the following:

1. Soft copper tube, [**ASTM B 88, Type K (ASTM B 88M, Type A)**] [**ASTM B 88, Type L (ASTM B 88M, Type B)**]; wrought-copper, solder-joint fittings; and brazed joints.
2. Ductile-iron, **push-on-joint pipe; ductile-iron, push-on-joint fittings; and gasketed mechanical-joint pipe; ductile-iron, mechanical-joint fittings; and mechanical** joints.
3. NPS 4 and NPS 6 (DN 100 and DN 150): NPS 6 (DN 150) PVC, AWWA Class 150 pipe; PVC, AWWA Class 150 molded fittings; and gasketed joints.

G. Aboveground **and vault** water-service piping **NPS 4 and NPS 6 (DN 100 and DN 150)** shall be **any of** the following:

1. Hard copper tube, **ASTM B 88, Type K (ASTM B 88M, Type A) ASTM B 88, Type L (ASTM B 88M, Type B)**; wrought-copper, solder-joint fittings; and brazed joints.
2. Ductile-iron, grooved-end pipe; ductile-iron, grooved-end appurtenances; and grooved joints.

3.3 VALVE APPLICATIONS

A. General Application: Use mechanical-joint-end valves for NPS 3 (DN 80) and larger underground installation. Use threaded- or flanged-end valves for installation in vaults. Use UL/FMG, nonrising-stem gate valves for installation with indicator posts. Use corporation valves and curb valves with ends compatible with piping, for NPS 2 (DN 50) and smaller installation.

B. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:
1. Underground Valves, NPS 4 (DN 100) and Larger, for Indicator Posts: UL/FMG, cast-iron, nonrising-stem gate valves with indicator post.
2. Use the following for valves in vaults and aboveground:

a. Gate Valves, NPS 2 (DN 50) and Smaller: Bronze stem.
b. Gate Valves, NPS 3 (DN 80) and Larger: **AWWA, cast iron, OS&Y rising stem, metal seated AWWA, cast iron, OS&Y rising stem, resilient seated UL/FMG, cast iron, OS&Y rising stem**.

3.4 PIPING SYSTEMS - COMMON REQUIREMENTS

A. See Section 330500 "Common Work Results for Utilities" for piping-system common requirements.

3.5 PIPING INSTALLATION

A. Water-Main Connection: Arrange with utility company for tap of size and in location indicated in water main.

B. Water-Main Connection: Tap water main according to requirements of water utility company and of size and in location indicated.

C. Make connections larger than NPS 2 (DN 50) with tapping machine according to the following:

1. Install tapping sleeve and tapping valve according to MSS SP-60.
2. Install tapping sleeve on pipe to be tapped. Position flanged outlet for gate valve.
3. Use tapping machine compatible with valve and tapping sleeve; cut hole in main. Remove tapping machine and connect water-service piping.
4. Install gate valve onto tapping sleeve. Comply with MSS SP-60. Install valve with stem pointing up and with valve box.

D. Make connections NPS 2 (DN 50) and smaller with drilling machine according to the following:

1. Install service-saddle assemblies and corporation valves in size, quantity, and arrangement required by utility company standards.
2. Install service-saddle assemblies on water-service pipe to be tapped. Position outlets for corporation valves.
3. Use drilling machine compatible with service-saddle assemblies and corporation valves. Drill hole in main. Remove drilling machine and connect water-service piping.
4. Install corporation valves into service-saddle assemblies.
5. Install manifold for multiple taps in water main.
6. Install curb valve in water-service piping with head pointing up and with service box.

E. Comply with NFPA 24 for fire-service-main piping materials and installation.

1. Install copper tube and fittings according to CDA's "Copper Tube Handbook."

F. Install ductile-iron, water-service piping according to AWWA C600 and AWWA M41.

G. Install PE pipe according to ASTM D 2774 and ASTM F 645.

H. Install PVC, AWWA pipe according to ASTM F 645 and AWWA M23.

I. Bury piping with depth of cover over top at least **30 inches (750 mm)** , with top at least **12 inches (300 mm)** below level of maximum frost penetration.

J. Extend water-service piping and connect to water-supply source and building-water-piping systems at outside face of building wall in locations and pipe sizes indicated.

1. Terminate water-service piping at building wall until building-water-piping systems are installed. Terminate piping with caps, plugs, or flanges as required for piping material. Make connections to building-water-piping systems when those systems are installed.

K. Sleeves are specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."

L. Mechanical sleeve seals are specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."

M. Install underground piping with restrained joints at horizontal and vertical changes in direction. Use restrained-joint piping, thrust blocks, anchors, tie-rods and clamps, and other supports.

3.6 JOINT CONSTRUCTION

A. See Section 330500 "Common Work Results for Utilities" for basic piping joint construction.

B. Make pipe joints according to the following:

1. Ductile-Iron Piping, Gasketed Joints for Water-Service Piping: AWWA C600 and AWWA M41.
2. Ductile-Iron Piping, Gasketed Joints for Fire-Service-Main Piping: UL 194.
3. Ductile-Iron Piping, Grooved Joints: Cut-groove pipe. Assemble joints with grooved-end, ductile-iron-piping couplings, gaskets, lubricant, and bolts according to coupling manufacturer's written instructions.
4. PE Piping Insert-Fitting Joints: Use plastic insert fittings and fasteners according to fitting manufacturer's written instructions.
5. PVC Piping Gasketed Joints: Use joining materials according to AWWA C900. Construct joints with elastomeric seals and lubricant according to ASTM D 2774 or ASTM D 3139 and pipe manufacturer's written instructions.
6. Dissimilar Materials Piping Joints: Use adapters compatible with both piping materials, with OD, and with system working pressure.

3.7 ANCHORAGE INSTALLATION

A. Anchorage, General: Install water-distribution piping with restrained joints. Anchorages and restrained-joint types that may be used include the following:

1. Concrete thrust blocks.
2. Locking mechanical joints.
3. Set-screw mechanical retainer glands.
4. Bolted flanged joints.
5. Heat-fused joints.

6. Pipe clamps and tie rods.

B. Install anchorages for tees, plugs and caps, bends, crosses, valves, and hydrant branches. Include anchorages for the following piping systems:

1. Gasketed-Joint, Ductile-Iron, Water-Service Piping: According to AWWA C600.
2. Gasketed-Joint, PVC Water-Service Piping: According to AWWA M23.
3. Fire-Service-Main Piping: According to NFPA 24.

C. Apply full coat of asphalt or other acceptable corrosion-resistant material to surfaces of installed ferrous anchorage devices.

3.8 VALVE INSTALLATION

A. AWWA Gate Valves: Comply with AWWA C600 and AWWA M44. Install each underground valve with stem pointing up and with valve box.

B. UL/FMG, Gate Valves: Comply with NFPA 24. Install each underground valve and valves in vaults with stem pointing up and with vertical cast-iron indicator post.

C. MSS Valves: Install as component of connected piping system.

D. Corporation Valves and Curb Valves: Install each underground curb valve with head pointed up and with service box.

3.9 WATER METER INSTALLATION

A. Install water meters, piping, and specialties according to utility company's written instructions.

B. Water Meters: Install displacement-type water meters, NPS 2 (DN 50) and smaller, in meter boxes with shutoff valves on water meter inlets. Include valves on water meter outlets and valved bypass around meters unless prohibited by authorities having jurisdiction.

C. Water Meters: Install compound-type water meters, NPS 3 (DN 80) and larger, in meter vaults. Include shutoff valves on water meter inlets and outlets and valved bypass around meters. Support meters, valves, and piping on brick or concrete piers.

3.10 BACKFLOW PREVENTER INSTALLATION

A. Install backflow preventers of type, size, and capacity indicated. Include valves and test cocks. Install according to requirements of plumbing and health department and authorities having jurisdiction.

B. Do not install backflow preventers that have relief drain in vault or in other spaces subject to flooding.

C. Do not install bypass piping around backflow preventers.

D. Support NPS 2-1/2 (DN 65) and larger backflow preventers, valves, and piping near floor and on brick or concrete piers.

3.11 CONCRETE VAULT INSTALLATION

A. Install precast concrete vaults according to ASTM C 891.

3.12 FIRE HYDRANT INSTALLATION

A. General: Install each fire hydrant with separate gate valve in supply pipe, anchor with restrained joints or thrust blocks, and support in upright position.

B. Wet-Barrel Fire Hydrants: Install with valve below frost line. Provide for drainage.

C. AWWA Fire Hydrants: Comply with AWWA M17.

D. UL/FMG Fire Hydrants: Comply with NFPA 24.

3.13 CONNECTIONS

A. See Section 330500 "Common Work Results for Utilities" for piping connections to valves and equipment.

B. Connect water-distribution piping to **utility water main**. Use **tapping sleeve and tapping valve, service clamp and corporation valve** .

C. Connect water-distribution piping to interior **domestic water** piping.

3.14 FIELD QUALITY CONTROL

A. Piping Tests: Conduct piping tests before joints are covered and after concrete thrust blocks have hardened sufficiently. Fill pipeline 24 hours before testing and apply test pressure to stabilize system. Use only potable water.

B. Hydrostatic Tests: Test at not less than one-and-one-half times working pressure for two hours.

1. Increase pressure in 50-psig (350-kPa) increments and inspect each joint between increments. Hold at test pressure for 1 hour; decrease to 0 psig (0 kPa). Slowly increase again to test pressure and hold for 1 more hour. Maximum allowable leakage is 2 quarts (1.89 L) per hour per 100 joints. Remake leaking joints with new materials and repeat test until leakage is within allowed limits.

C. Prepare reports of testing activities.

3.15 IDENTIFICATION

A. Install continuous underground[**detectable**] warning tape during backfilling of trench for underground water-distribution piping. Locate below finished grade, directly over piping. Underground warning tapes are specified in Section 312000 "Earth Moving."

B. Permanently attach equipment nameplate or marker indicating plastic water-service piping, on main electrical meter panel. See Section 330500 "Common Work Results for Utilities" for identifying devices.

3.16 CLEANING

A. Clean and disinfect water-distribution piping as follows:

1. Purge new water-distribution piping systems and parts of existing systems that have been altered, extended, or repaired before use.
2. Use purging and disinfecting procedure prescribed by authorities having jurisdiction or, if method is not prescribed by authorities having jurisdiction, use procedure described in NFPA 24 for flushing of piping. Flush piping system with clean, potable water until dirty water does not appear at points of outlet.
3. Use purging and disinfecting procedure prescribed by authorities having jurisdiction or, if method is not prescribed by authorities having jurisdiction, use procedure described in AWWA C651 or do as follows:

    a. Fill system or part of system with water/chlorine solution containing at least 50 ppm of chlorine; isolate and allow to stand for 24 hours.
    b. Drain system or part of system of previous solution and refill with water/chlorine solution containing at least 200 ppm of chlorine; isolate and allow to stand for 3 hours.
    c. After standing time, flush system with clean, potable water until no chlorine remains in water coming from system.
    d. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedure if biological examination shows evidence of contamination.

B. Prepare reports of purging and disinfecting activities.

END OF SECTION 221113

SECTION 221116

DOMESTIC WATER PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes under-building-slab and aboveground domestic water pipes, tubes, and fittings inside buildings.

B. Related Requirements:

1. Section 221113 "Facility Water Distribution Piping" for water-service piping **and water meters** outside the building from source to the point where water-service piping enters the building.

1.2 ACTION SUBMITTALS

A. Product Data: For transition fittings and dielectric fittings.

B. LEED Submittals:

1. Product Data for Credit IEQ 4.1: For solvent cements and adhesive primers, documentation including printed statement of VOC content.
2. Laboratory Test Reports for Credit IEQ 4: For solvent cements and adhesive primers, documentation indicating that products comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

1.3 INFORMATIONAL SUBMITTALS

A. System purging and disinfecting activities report.

B. Field quality-control reports.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

B. Potable-water piping and components shall comply with NSF 14 and NSF 61. Plastic piping components shall be marked with "NSF-pw."

2.2 COPPER TUBE AND FITTINGS

A. Hard Copper Tube: **ASTM B 88, Type L (ASTM B 88M, Type B) and ASTM B 88, Type M (ASTM B 88M, Type C)** water tube, drawn temper.

B. Soft Copper Tube: **ASTM B 88, Type K (ASTM B 88M, Type A) and ASTM B 88, Type L (ASTM B 88M, Type B)** water tube, annealed temper.

C. Cast-Copper, Solder-Joint Fittings: ASME B16.18, pressure fittings.

D. Wrought-Copper, Solder-Joint Fittings: ASME B16.22, wrought-copper pressure fittings.

E. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends.

F. Copper Unions:

1. MSS SP-123.
2. Cast-copper-alloy, hexagonal-stock body.
3. Ball-and-socket, metal-to-metal seating surfaces.
4. Solder-joint or threaded ends.

G. Copper Pressure-Seal-Joint Fittings:

1. Fittings for NPS 2 (DN 50) and Smaller: Wrought-copper fitting with EPDM-rubber, O-ring seal in each end.
2. Fittings for NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Cast-bronze or wrought-copper fitting with EPDM-rubber, O-ring seal in each end.

H. Copper Push-on-Joint Fittings:

1. Cast-copper fitting complying with ASME B16.18 or wrought-copper fitting complying with ASME B 16.22.
2. Stainless-steel teeth and EPDM-rubber, O-ring seal in each end instead of solder-joint ends.

2.3 DUCTILE-IRON PIPE AND FITTINGS

A. Mechanical-Joint, Ductile-Iron Pipe:

1. AWWA C151/A21.51, with mechanical-joint bell and plain spigot end unless grooved or flanged ends are indicated.
2. Glands, Gaskets, and Bolts: AWWA C111/A21.11, ductile- or gray-iron glands, rubber gaskets, and steel bolts.

B. Standard-Pattern, Mechanical-Joint Fittings:

1. AWWA C110/A21.10, ductile or gray iron.
2. Glands, Gaskets, and Bolts: AWWA C111/A21.11, ductile- or gray-iron glands, rubber gaskets, and steel bolts.

C. Compact-Pattern, Mechanical-Joint Fittings:

1. AWWA C153/A21.53, ductile iron.
2. Glands, Gaskets, and Bolts: AWWA C111/A21.11, ductile- or gray-iron glands, rubber gaskets, and steel bolts.

2.4 GALVANIZED-STEEL PIPE AND FITTINGS

A. Galvanized-Steel Pipe:

1. ASTM A 53/A 53M, **Type E**, Standard Weight.
2. Include ends matching joining method.

B. Galvanized-Steel Pipe Nipples: ASTM A 733, made of ASTM A 53/A 53M or ASTM A 106/A 106M, Standard Weight, seamless steel pipe with threaded ends.

C. Galvanized, Gray-Iron Threaded Fittings: ASME B16.4, Class 125, standard pattern.

D. Malleable-Iron Unions:

1. ASME B16.39, Class 150.
2. Hexagonal-stock body.
3. Ball-and-socket, metal-to-metal, bronze seating surface.
4. Threaded ends.

E. Flanges: ASME B16.1, Class 125, cast iron.

2.5 CPVC PIPING

A. CPVC Pipe: ASTM F 441/F 441M, **Schedule 40 and Schedule 80**.

1. CPVC Socket Fittings: **ASTM F 438 for Schedule 40 and ASTM F 439 for Schedule 80**.
2. CPVC Threaded Fittings: ASTM F 437, Schedule 80.

B. CPVC Piping System: ASTM D 2846/D 2846M, SDR 11, pipe and socket fittings.

C. CPVC Tubing System: ASTM D 2846/D 2846M, SDR 11, tube and socket fittings.

2.6 PEX TUBE AND FITTINGS

A. Tubing shall be PEX-A type and fittings shall be equal to Uponor Aquapex. Tubing and fittings shall conform to ASTM F876 “standard specification for crosslinked polyethylene, ASTM F877 “standard for crosslinked polyethylene plastic hot and cold water distribution systems”. Provide engineered plastic fittings with plastic collars which

conform to ASTM F1960 standard specification for cold expansion fittings with PEX reinforcing rings for use with crosslinked polyethylene piping. PEX tubing and connections shall be warranted for a period of 25 years. Do not weld, glue, tape or allow other solvent based adhesives or paints to come into contact with tubing. Do not allow tubing to come in contact with pipe thread compounds, firewall penetration sealing compounds, and petroleum based sealants. Do not allow tubing to come within 6” of gas appliance vents or 12” of recessed light fixtures. Do not expose tubing to open flame. Do not solder within 18” of tubing. Do not install tubing between tub spout and shower valve. Radius of bends shall not exceed six times outside tube diameter. Repair kinks in tubing using heat as recommended by manufacturer. Tubing shall be installed in maximum practical lengths, as directly as possible to remote manifold with minimum fittings. Tubing shall be supported in a matter that does not damage tubing and allows for thermal expansion. Supports shall be spaced at 32” minimum horizontally and 60” vertically and within 6” of fittings or bends. Use bend supports at 90 degree bends. Protect installed tubing from damage. Install metal plates where tubing penetrates studs at face of studs. Remote manifold type fittings shall be utilized at branches in rooms where tubing is terminated (modified home-run installation type). Utilize expander tools recommended by manufacturer for connection of tubing to fittings. Do not over expand tubing. Pipe shall be supported at fittings and fixtures as recommended by manufacturer. Piping shall be installed with minimum amount of fittings. Use manufacturer approved valves, fittings, hose bibs and boxes at fixtures.

2.7 PVC PIPE AND FITTINGS

A. PVC Pipe: ASTM D 1785, **Schedule 40 and Schedule 80**.

B. PVC Socket Fittings: **ASTM D 2466 for Schedule 40 and ASTM D 2467 for Schedule 80**.

C. PVC Schedule 80 Threaded Fittings: ASTM D 2464.

2.8 PIPING JOINING MATERIALS

A. Pipe-Flange Gasket Materials:

1. AWWA C110/A21.10, rubber, flat face, 1/8 inch (3.2 mm) thick or ASME B16.21, nonmetallic and asbestos free unless otherwise indicated.
2. 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. Solder Filler Metals: ASTM B 32, lead-free alloys.

D. Flux: ASTM B 813, water flushable.

E. Brazing Filler Metals: AWS A5.8/A5.8M, BCuP Series, copper-phosphorus alloys for general-duty brazing unless otherwise indicated.

F. Solvent Cements for Joining CPVC Piping and Tubing: ASTM F 493.

1. CPVC solvent cement shall have a VOC content of 490 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. Adhesive primer shall have a VOC content of 550 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
3. Solvent cement and adhesive primer shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

G. Solvent Cements for Joining PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.

1. PVC solvent cement shall have a VOC content of 510 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. Adhesive primer shall have a VOC content of 550 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
3. Solvent cement and adhesive primer shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

H. Plastic, Pipe-Flange Gaskets, Bolts, and Nuts: Type and material recommended by piping system manufacturer unless otherwise indicated.

2.9 TRANSITION FITTINGS

A. General Requirements:

1. Same size as pipes to be joined.
2. Pressure rating at least equal to pipes to be joined.
3. End connections compatible with pipes to be joined.

B. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.

C. Plastic-to-Metal Transition Fittings:

1. Description:

a. **CPVc**] **or PVC** one-piece fitting with manufacturer's Schedule 80 equivalent dimensions.
b. One end with threaded brass insert and one solvent-cement-socket **or threaded** end.

D. Plastic-to-Metal Transition Unions:

1. Description:

a. **CPVC or PVC** four-part union.
b. Brass **or stainless-steel** threaded end.
c. Solvent-cement-joint **or threaded** plastic end.
d. Rubber O-ring.
e. Union nut.

2.10 DIELECTRIC FITTINGS

A. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.

B. Dielectric Unions:

1. Standard: ASSE 1079.
2. Pressure Rating: **125 psig (860 kPa) minimum at 180 deg F (82 deg C) 150 psig (1035 kPa) 250 psig (1725 kPa)**.
3. End Connections: Solder-joint copper alloy and threaded ferrous.

C. Dielectric Flanges:

1. Standard: ASSE 1079.
2. Factory-fabricated, bolted, companion-flange assembly.
3. Pressure Rating: **125 psig (860 kPa) minimum at 180 deg F (82 deg C) 150 psig (1035 kPa) 175 psig (1200 kPa) 300 psig (2070 kPa)**.
4. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.

D. Dielectric-Flange Insulating Kits:

1. Nonconducting materials for field assembly of companion flanges.
2. Pressure Rating: **150 psig (1035 kPa)**.
3. Gasket: Neoprene or phenolic.
4. Bolt Sleeves: Phenolic or polyethylene.
5. Washers: Phenolic with steel backing washers.

E. Dielectric Nipples:

1. Standard: IAPMO PS 66.
2. Electroplated steel nipple complying with ASTM F 1545.
3. Pressure Rating and Temperature: **300 psig (2070 kPa) at 225 deg F (107 deg C)**.
4. End Connections: Male threaded or grooved.
5. Lining: Inert and noncorrosive, propylene.

PART 3 - EXECUTION

3.1 EARTHWORK

A. Comply with requirements in Section 312000 "Earth Moving" for excavating, trenching, and backfilling.

3.2 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of domestic water piping. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.

B. Install copper tubing under building slab according to CDA's "Copper Tube Handbook."

C. Install ductile-iron piping under building slab with restrained joints according to AWWA C600 and AWWA M41.

D. Install shutoff valve, hose-end drain valve, strainer, pressure gage, and test tee with valve inside the building at each domestic water-service entrance. Comply with requirements for pressure gages in Section 220519 "Meters and Gages for Plumbing Piping" and with requirements for drain valves and strainers in Section 221119 "Domestic Water Piping Specialties."

E. Install shutoff valve immediately upstream of each dielectric fitting.

F. Install water-pressure-reducing valves downstream from shutoff valves. Comply with requirements for pressure-reducing valves in Section 221119 "Domestic Water Piping Specialties."

G. Install domestic water piping level [**with 0.25 percent slope downward toward drain**] [**without pitch**] and plumb.

H. Rough-in domestic water piping for water-meter installation according to utility company's requirements.

I. Install seismic restraints on piping. Comply with requirements for seismic-restraint devices in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."

J. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.

K. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

L. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.

M. Install piping to permit valve servicing.

N. Install nipples, unions, special fittings, and valves with pressure ratings the same as or higher than the system pressure rating used in applications below unless otherwise indicated.

O. Install piping free of sags and bends.

P. Install fittings for changes in direction and branch connections.

Q. Install PEX piping with loop at each change of direction of more than 90 degrees.

R. Install unions in copper tubing at final connection to each piece of equipment, machine, and specialty.

S. Install pressure gages on suction and discharge piping for each plumbing pump and packaged booster pump. Comply with requirements for pressure gages in Section 220519 "Meters and Gages for Plumbing Piping."

T. Install thermostats in hot-water circulation piping. Comply with requirements for thermostats in Section 221123 "Domestic Water Pumps."

U. Install thermometers on **inlet and** outlet piping from each water heater. Comply with requirements for thermometers in Section 220519 "Meters and Gages for Plumbing Piping."

V. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."

W. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."

X. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 220518 "Escutcheons for Plumbing Piping."

3.3 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 pipes, tubes, and fittings before assembly.

C. Threaded Joints: Thread pipe with tapered pipe threads according to 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.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.

D. Brazed Joints for Copper Tubing: Comply with CDA's "Copper Tube Handbook," "Brazed Joints" chapter.

E. Soldered Joints for Copper Tubing: Apply ASTM B 813, water-flushable flux to end of tube. Join copper tube and fittings according to ASTM B 828 or CDA's "Copper Tube Handbook."

F. Pressure-Sealed Joints for Copper Tubing: Join copper tube and pressure-seal fittings with tools recommended by fitting manufacturer.

G. Flanged Joints: Select appropriate asbestos-free, nonmetallic gasket material in size, type, and thickness suitable for domestic water service. Join flanges with gasket and bolts according to ASME B31.9.

H. Joint Construction for Solvent-Cemented Plastic Piping: Clean and dry joining surfaces. Join pipe and fittings according to the following:

1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements. Apply primer.
2. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.
3. PVC Piping: Join according to ASTM D 2855.

I. Joints for PEX Piping: Join according to ASTM F 1807.

J. Joints for Dissimilar-Material Piping: Make joints using adapters compatible with materials of both piping systems.

3.4 TRANSITION FITTING INSTALLATION

A. Install transition couplings at joints of dissimilar piping.

B. Transition Fittings in Underground Domestic Water Piping:

1. Fittings for NPS 1-1/2 (DN 40) and Smaller: Fitting-type coupling.
2. Fittings for NPS 2 (DN 50) and Larger: Sleeve-type coupling.

C. Transition Fittings in Aboveground Domestic Water Piping NPS 2 (DN 50) and Smaller: Plastic-to-metal transition.

3.5 HANGER AND SUPPORT INSTALLATION

A. Comply with requirements for seismic-restraint devices in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."

B. Comply with requirements for pipe hanger, support products, and installation in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."

1. Vertical Piping: MSS Type 8 or 42, clamps.
2. Individual, Straight, Horizontal Piping Runs:

    a. 100 Feet (30 m) and Less: MSS Type 1, adjustable, steel clevis hangers.
    b. Longer Than 100 Feet (30 m): MSS Type 43, adjustable roller hangers.
    c. Longer Than 100 Feet (30 m) if Indicated: MSS Type 49, spring cushion rolls.

3. Multiple, Straight, Horizontal Piping Runs 100 Feet (30 m) or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
4. Base of Vertical Piping: MSS Type 52, spring hangers.

C. Support vertical piping and tubing at base and at each floor.

D. Rod diameter may be reduced one size for double-rod hangers, to a minimum of 3/8 inch (10 mm).

E. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 3/4 (DN 20) and Smaller: 60 inches (1500 mm) with 3/8-inch (10-mm) rod.
2. NPS 1 and NPS 1-1/4 (DN 25 and DN 32): 72 inches (1800 mm) with 3/8-inch (10-mm) rod.
3. NPS 1-1/2 and NPS 2 (DN 40 and DN 50): 96 inches (2400 mm) with 3/8-inch (10-mm) rod.
4. NPS 2-1/2 (DN 65): 108 inches (2700 mm) with 1/2-inch (13-mm) rod.
5. NPS 3 to NPS 5 (DN 80 to DN 125): 10 feet (3 m) with 1/2-inch (13-mm) rod.
6. NPS 6 (DN 150): 10 feet (3 m) with 5/8-inch (16-mm) rod.
7. NPS 8 (DN 200): 10 feet (3 m) with 3/4-inch (19-mm) rod.

F. Install supports for vertical copper tubing every 10 feet (3 m).

G. Install hangers for steel piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/4 (DN 32) and Smaller: 84 inches (2100 mm) with 3/8-inch (10-mm) rod.
2. NPS 1-1/2 (DN 40): 108 inches (2700 mm) with 3/8-inch (10-mm) rod.
3. NPS 2 (DN 50): 10 feet (3 m) with 3/8-inch (10-mm) rod.
4. NPS 2-1/2 (DN 65): 11 feet (3.4 m) with 1/2-inch (13-mm) rod.
5. NPS 3 and NPS 3-1/2 (DN 80 and DN 90): 12 feet (3.7 m) with 1/2-inch (13-mm) rod.
6. NPS 4 and NPS 5 (DN 100 and DN 125): 12 feet (3.7 m) with 5/8-inch (16-mm) rod.

7. NPS 6 (DN 150): 12 feet (3.7 m) with 3/4-inch (19-mm) rod.
8. NPS 8 to NPS 12 (DN 200 to DN 300): 12 feet (3.7 m) with 7/8-inch (22-mm) rod.

H. Install supports for vertical steel piping every 15 feet (4.5 m).

I. Install vinyl-coated hangers for CPVC piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1 (DN 25) and Smaller: 36 inches (900 mm) with 3/8-inch (10-mm) rod.
2. NPS 1-1/4 to NPS 2 (DN 32 to DN 50): 48 inches (1200 mm) with 3/8-inch (10-mm) rod.
3. NPS 2-1/2 to NPS 3-1/2 (DN 65 to DN 90): 48 inches (1200 mm) with 1/2-inch (13-mm) rod.
4. NPS 4 and NPS 5 (DN 100 and DN 125): 48 inches (1200 mm) with 5/8-inch (16-mm) rod.
5. NPS 6 (DN 150): 48 inches (1200 mm) with 3/4-inch (19-mm) rod.
6. NPS 8 (DN 200): 48 inches (1200 mm) with 7/8-inch (22-mm) rod.

J. Install supports for vertical CPVC piping every 60 inches (1500 mm) for NPS 1 (DN 25) and smaller, and every 72 inches (1800 mm) for NPS 1-1/4 (DN 32) and larger.

K. Install vinyl-coated hangers for PEX piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1 (DN 25) and Smaller: 32 inches (815 mm) with 3/8-inch (10-mm) rod.

L. Install hangers for vertical PEX piping every 48 inches (1200 mm).

M. Install vinyl-coated hangers for PVC piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 2 (DN 50) and Smaller: 48 inches (1200 mm) with 3/8-inch (10-mm) rod.
2. NPS 2-1/2 to NPS 3-1/2 (DN 65 to DN 90): 48 inches (1200 mm) with 1/2-inch (13-mm) rod.
3. NPS 4 and NPS 5 (DN 100 and DN 125): 48 inches (1200 mm) with 5/8-inch (16-mm) rod.
4. NPS 6 (DN 150): 48 inches (1200 mm) with 3/4-inch (19-mm) rod.
5. NPS 8 (DN 200): 48 inches (1200 mm) with 7/8-inch (22-mm) rod.

N. Install supports for vertical PVC piping every 48 inches (1200 mm).

O. Support piping and tubing not listed in this article according to MSS SP-69 and manufacturer's written instructions.

3.6 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. When installing piping adjacent to equipment and machines, allow space for service and maintenance.

C. Connect domestic water piping to exterior water-service piping. Use transition fitting to join dissimilar piping materials.

D. Connect domestic water piping to water-service piping with shutoff valve; extend and connect to the following:

1. Domestic Water Booster Pumps: Cold-water suction and discharge piping.
2. Water Heaters: Cold-water inlet and hot-water outlet piping in sizes indicated, but not smaller than sizes of water heater connections.
3. Plumbing Fixtures: Cold- and hot-water-supply piping in sizes indicated, but not smaller than that required by plumbing code.
4. Equipment: Cold- and hot-water-supply piping as indicated, but not smaller than equipment connections. Provide shutoff valve and union for each connection. Use flanges instead of unions for NPS 2-1/2 (DN 65) and larger.

3.7 IDENTIFICATION

A. Identify system components. Comply with requirements for identification materials and installation in Section 220553 "Identification for Plumbing Piping and Equipment."

B. Label pressure piping with system operating pressure.

3.8 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Piping Inspections:

a. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.
b. During installation, notify authorities having jurisdiction at least one day before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:

1) Roughing-in Inspection: Arrange for inspection of piping before concealing or closing in after roughing in and before setting fixtures.
2) Final Inspection: Arrange for authorities having jurisdiction to observe tests specified in "Piping Tests" Subparagraph below and to ensure compliance with requirements.

c. Reinspection: If authorities having jurisdiction find that piping will not pass tests or inspections, make required corrections and arrange for reinspection.
d. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

2. Piping Tests:

a. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.
b. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit a separate report for each test, complete with diagram of portion of piping tested.
c. Leave new, altered, extended, or replaced domestic water piping uncovered and unconcealed until it has been tested and approved. Expose work that was covered or concealed before it was tested.
d. Cap and subject piping to static water pressure of 50 psig (345 kPa) above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow it to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
e. Repair leaks and defects with new materials, and retest piping or portion thereof until satisfactory results are obtained.
f. Prepare reports for tests and for corrective action required.

B. Domestic water piping will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

3.9 ADJUSTING

A. Perform the following adjustments before operation:

1. Close drain valves, hydrants, and hose bibbs.
2. Open shutoff valves to fully open position.
3. Open throttling valves to proper setting.
4. Adjust balancing valves in hot-water-circulation return piping to provide adequate flow.

    a. Manually adjust ball-type balancing valves in hot-water-circulation return piping to provide hot-water flow in each branch.
    b. Adjust calibrated balancing valves to flows indicated.

5. Remove plugs used during testing of piping and for temporary sealing of piping during installation.
6. Remove and clean strainer screens. Close drain valves and replace drain plugs.
7. Remove filter cartridges from housings and verify that cartridges are as specified for application where used and are clean and ready for use.
8. Check plumbing specialties and verify proper settings, adjustments, and operation.

3.10 CLEANING

A. Clean and disinfect potable domestic water piping as follows:

1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction; if methods are not prescribed, use procedures described in either AWWA C651 or AWWA C652 or follow procedures described below:

    a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
    b. Fill and isolate system according to either of the following:

        1) Fill system or part thereof with water/chlorine solution with at least 50 ppm (50 mg/L) of chlorine. Isolate with valves and allow to stand for 24 hours.
        2) Fill system or part thereof with water/chlorine solution with at least 200 ppm (200 mg/L) of chlorine. Isolate and allow to stand for three hours.

    c. Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.
    d. Repeat procedures if biological examination shows contamination.
    e. Submit water samples in sterile bottles to authorities having jurisdiction.

B. Prepare and submit reports of purging and disinfecting activities. Include copies of water-sample approvals from authorities having jurisdiction.

C. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

3.11 PIPING SCHEDULE

A. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.

B. Flanges and unions may be used for aboveground piping joints unless otherwise indicated.

C. Fitting Option: Extruded-tee connections and brazed joints may be used on aboveground copper tubing.

D. Under-building-slab, domestic water, building-service piping, **NPS 4 to NPS 8 (DN 100 to DN 200) and larger** shall be **one of** the following:

1. Soft copper tube, **ASTM B 88, Type K (ASTM B 88M, Type A) ASTM B 88, Type L (ASTM B 88M, Type B)**; wrought-copper, solder-joint fittings; and brazed joints.
2. Plain-end, ductile-iron pipe; grooved-joint, ductile-iron-pipe appurtenances; and grooved joints.
3. PVC, **Schedule 40 Schedule 80**; socket fittings; and solvent-cemented joints.

E. Aboveground domestic water piping, **NPS 2 (DN 50) and smaller**, shall be **one of** the following:

1. Galvanized-steel pipe and nipples; galvanized, gray-iron threaded fittings; and threaded joints.
2. Hard copper tube, **ASTM B 88, Type L (ASTM B 88M, Type B) ASTM B 88, Type M (ASTM B 88M, Type C)**; **cast- or wrought-**copper, solder-joint fittings; and **brazed soldered** joints.
3. Hard copper tube, **ASTM B 88, Type L (ASTM B 88M, Type B) or ASTM B 88, Type M (ASTM B 88M, Type C)**; copper pressure-seal-joint fittings; and pressure-sealed joints.
4. CPVC, **Schedule 40 Schedule 80**; socket fittings; and solvent-cemented joints.
5. CPVC, Schedule 80 pipe; CPVC, Schedule 80 threaded fittings; and threaded joints.
6. CPVC Tubing System: CPVC tube; CPVC socket fittings; and solvent-cemented joints. **NPS 1-1/2 (DN 40) and NPS 2 (DN 50) CPVC pipe with CPVC socket fittings may be used instead of tubing.**
7. PEX tube, NPS 1 (DN 25) and smaller; fittings for PEX tube; and crimped joints.

F. Aboveground domestic water piping, **NPS 2-1/2 to NPS 4 (DN 65 to DN 100)**, shall be **one of** the following:

1. Hard copper tube, **ASTM B 88, Type L (ASTM B 88M, Type B) ASTM B 88, Type M (ASTM B 88M, Type C)**; **cast- or wrought-**copper, solder-joint fittings; and **brazed soldered** joints.
2. Hard copper tube, **ASTM B 88, Type L (ASTM B 88M, Type B) or ASTM B 88, Type M (ASTM B 88M, Type C)**; copper pressure-seal-joint fittings; and pressure-sealed joints.
3. Hard copper tube, **ASTM B 88, Type L (ASTM B 88M, Type B) or ASTM B 88, Type M (ASTM B 88M, Type C)**; grooved-joint, copper-tube appurtenances; and grooved joints.
4. Galvanized-steel pipe and nipples; galvanized, gray-iron threaded fittings; and threaded joints.
5. CPVC, **Schedule 40 Schedule 80**; socket fittings; and solvent-cemented joints.
6. CPVC, Schedule 80 pipe; CPVC, Schedule 80 threaded fittings; and threaded joints.
7. PVC, **Schedule 40 Schedule 80**; socket fittings; and solvent-cemented joints.

END OF SECTION 221116

6

SECTION 221119

DOMESTIC WATER PIPING SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Vacuum breakers.
2. Backflow preventers.
3. Water pressure-reducing valves.
4. Balancing valves.
5. Temperature-actuated, water mixing valves.
6. Strainers.
7. Hose bibbs.
8. Wall hydrants.
9. Drain valves.
10. Water-hammer arresters.
11. Trap-seal primer valves.

B. Related Requirements:

1. Section 220519 "Meters and Gages for Plumbing Piping" for thermometers, pressure gages, and flow meters in domestic water piping.
2. Section 221116 "Domestic Water Piping" for water meters.
3. Section 223200 "Domestic Water Filtration Equipment" for water filters in domestic water piping.
4. Section 224300 "Medical Plumbing Fixtures" for thermostatic mixing valves for sitz baths, thermostatic mixing-valve assemblies for hydrotherapy equipment, and outlet boxes for dialysis equipment.
5. Section 224500 "Emergency Plumbing Fixtures" for water tempering equipment.
6. Section 224713 "Drinking Fountains" for water filters for water coolers.
7. Section 224716 "Pressure Water Coolers" for water filters for water coolers.
8. Section 224723 "Remote Water Coolers" for water filters for water coolers.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.3 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.4 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR PIPING SPECIALTIES

A. Potable-water piping and components shall comply with NSF 61 **and NSF 14**. **Mark "NSF-pw" on plastic piping components.**

2.2 PERFORMANCE REQUIREMENTS

A. Minimum Working Pressure for Domestic Water Piping Specialties: **125 psig (860 kPa)** unless otherwise indicated.

2.3 VACUUM BREAKERS

A. Pipe-Applied, Atmospheric-Type Vacuum Breakers

1. Standard: ASSE 1001.
2. Size: NPS 1/4 to NPS 3 (DN 8 to DN 80), as required to match connected piping.
3. Body: Bronze.
4. Inlet and Outlet Connections: Threaded.
5. Finish: **Rough bronze, Chrome plated**.

B. Hose-Connection Vacuum Breakers:

1. Standard: ASSE 1011.
2. Body: Bronze, nonremovable, with manual drain.
3. Outlet Connection: Garden-hose threaded complying with ASME B1.20.7.
4. Finish: **Chrome or nickel plated, Rough bronze**.

2.4 BACKFLOW PREVENTERS

A. Intermediate Atmospheric-Vent Backflow Preventers:

1. Standard: ASSE 1012.
2. Operation: Continuous-pressure applications.
3. Size: **NPS 1/2 (DN 15) NPS 3/4 (DN 20)**.
4. Body: Bronze.
5. End Connections: **Union, solder** joint.
6. Finish: **Chrome plated, Rough bronze**.

B. Reduced-Pressure-Principle Backflow Preventers

1. Standard: ASSE 1013.

2. Operation: Continuous-pressure applications.
3. Pressure Loss: **12 psig (83 kPa)** maximum, through middle third of flow range.
4. Accessories:

    a. Valves NPS 2 (DN 50) and Smaller: Ball type with threaded ends on inlet and outlet.
    b. Valves NPS 2-1/2 (DN 65) and Larger: Outside-screw and yoke-gate type with flanged ends on inlet and outlet.
    c. Air-Gap Fitting: ASME A112.1.2, matching backflow-preventer connection.

2.5 BALANCING VALVES

A. Memory-Stop Balancing Valves :

1. Standard: MSS SP-110 for two-piece, copper-alloy ball valves.
2. Pressure Rating: 400-psig (2760-kPa) minimum CWP.
3. Size: NPS 2 (DN 50) or smaller.
4. Body: Copper alloy.
5. Port: Standard or full port.
6. Ball: Chrome-plated brass.
7. Seats and Seals: Replaceable.
8. End Connections: Solder joint or threaded.
9. Handle: Vinyl-covered steel with memory-setting device.

2.6 TEMPERATURE-ACTUATED, WATER MIXING VALVES

A. Water-Temperature Limiting Devices :

1. Standard: ASSE 1017.
2. Pressure Rating: 125 psig (860 kPa).
3. Type: Thermostatically controlled, water mixing valve.
4. Material: Bronze body with corrosion-resistant interior components.
5. Connections: Threaded **union** inlets and outlet.
6. Accessories: Check stops on hot- and cold-water supplies, and adjustable, temperature-control handle.

B. Primary, Thermostatic, Water Mixing Valves:

1. Standard: ASSE 1017.
2. Pressure Rating: 125 psig (860 kPa)minimum unless otherwise indicated.
3. Type: **Exposed-mounted, Cabinet-type**, thermostatically controlled, water mixing valve.
4. Material: Bronze body with corrosion-resistant interior components.
5. Connections: Threaded **union** inlets and outlet.
6. Accessories: Manual temperature control, check stops on hot- and cold-water supplies, and adjustable, temperature-control handle.

2.7 HOSE BIBBS

A. Hose Bibbs :

1. Standard: ASME A112.18.1 for sediment faucets.
2. Body Material: Bronze.
3. Seat: Bronze, replaceable.
4. Supply Connections: NPS 1/2 or NPS 3/4 (DN 15 or DN 20) threaded or solder-joint inlet.
5. Outlet Connection: Garden-hose thread complying with ASME B1.20.7.
6. Pressure Rating: 125 psig (860 kPa).
7. Vacuum Breaker: Integral[**or field-installation,**] nonremovable, drainable, hose-connection vacuum breaker complying with ASSE 1011.
8. Finish for Equipment Rooms: Rough bronze, or chrome or nickel plated.
9. Finish for Service Areas: [**Rough bronze**] [**Chrome or nickel plated**].
10. Finish for Finished Rooms: Chrome or nickel plated.
11. Operation for Equipment Rooms: Wheel handle or operating key.
12. Operation for Service Areas: [**Wheel handle**] [**Operating key**].
13. Operation for Finished Rooms: [**Wheel handle**] [**Operating key**].
14. Include operating key with each operating-key hose bibb.
15. Include[**integral**] wall flange with each chrome- or nickel-plated hose bibb.

2.8 WALL HYDRANTS

A. Nonfreeze Wall Hydrants :

1. Standard: ASME A112.21.3M for **concealed, exposed**-outlet, self-draining wall hydrants.
2. Pressure Rating: 125 psig (860 kPa).
3. Operation: Loose key.
4. Casing and Operating Rod: Of length required to match wall thickness. Include wall clamp.
5. Inlet: NPS 3/4 or NPS 1 (DN 20 or DN 25).
6. Outlet: Concealed, with integral vacuum breaker and garden-hose thread complying with ASME B1.20.7.
7. Box: Deep, flush mounted with cover.
8. Box and Cover Finish: **Polished nickel bronze Chrome plated**.
9. Outlet: Exposed, with integral vacuum breaker and garden-hose thread complying with ASME B1.20.7.
10. Nozzle and Wall-Plate Finish: **Polished nickel bronze Rough bronze**.
11. Operating Keys(s): **One** with each wall hydrant.

2.9 WATER-HAMMER ARRESTERS

A. Water-Hammer Arresters :

1. Standard: ASSE 1010 or PDI-WH 201.
2. Type: **Metal bellows, Copper tube with piston**.
3. Size: ASSE 1010, Sizes AA and A through F, or PDI-WH 201, Sizes A through F.

2.10 TRAP-SEAL PRIMER DEVICE

A. Manufacturers:
1. Watts Regulator Co.: www.watts.com (Basis of Design).
2. Jay R. Smith Manufacturing Company: www.jayrsmith.com.
3. Sioux Chief: www.siouxchief.com.
4. Wade Drains: www.wadedrains.com.
5. Zurn Industries, Inc: www.zurn.com.
6. Precision Plumbing Products (PPP): www.pppinc.net.

B. Trap Seal Protection Devices:
1. Trap Primer Valves:
a. Trap primer valves shall have brass finish, with 1/2 inch copper outlet. Trap primer valves shall be suitable for a working pressure of 30 psi-250 psi gauge pressure, and shall activate upon a 5 psi pressure drop in the supply line. Provide distributor(s) as required to service the proper number of traps (maximum 8 traps per trap primer valve).
b. Trap primer valves shall conform to ASSE Standard No. 1018.
c. Wade Model 4402 Trap Primer Valve or other compliant manufacturer's product
d. Wade Model 4402-DU Distribution Unit or other compliant manufacturer's product
2. Barrier-Type Trap Seal Protection Device:
a. Internally inserted, made of plyable material that allows liquids to pass through but will also create a vapor seal to maximize reduction of evaporation of the water trap seal.
b. Certified to ASSE 1072 standards and identified as such.
c. Install per manufacturer's written instructions and requirements, especially sizing per specific condition.
d. Wade #4405 Trap Seal Device (TSD), or other compliant manufacturer's product.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install backflow preventers in each water supply to mechanical equipment and systems and to other equipment and water systems that may be sources of contamination. Comply with authorities having jurisdiction.

1. Locate backflow preventers in same room as connected equipment or system.
2. Install drain for backflow preventers with atmospheric-vent drain connection with air-gap fitting, fixed air-gap fitting, or equivalent positive pipe separation of at least two pipe diameters in drain piping and pipe-to-floor drain. Locate air-gap device attached to or under backflow preventer. Simple air breaks are unacceptable for this application.
3. Do not install bypass piping around backflow preventers.

B. Install water regulators with inlet and outlet shutoff valves **and bypass with memory-stop balancing valve**. Install pressure gages on inlet and outlet.

C. Install balancing valves in locations where they can easily be adjusted.

D. Install temperature-actuated, water mixing valves with check stops or shutoff valves on inlets and with shutoff valve on outlet.

1. Install cabinet-type units recessed in or surface mounted on wall as specified.

E. Install Y-pattern strainers for water on supply side of each **control valve**.

F. Set nonfreeze, nondraining-type post hydrants in concrete or pavement.

G. Set freeze-resistant yard hydrants with riser pipe in concrete or pavement. Do not encase canister in concrete.

H. Install water-hammer arresters in water piping according to PDI-WH 201.

I. Install supply-type, trap-seal primer valves with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting. Adjust valve for proper flow.

J. Install drainage-type, trap-seal primer valves as lavatory trap with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting.

3.2 CONNECTIONS

A. Comply with requirements for ground equipment in Section 260526 "Grounding and Bonding for Electrical Systems."

B. Fire-retardant-treated-wood blocking is specified in Section 260519 "Low-Voltage Electrical Power Conductors and Cables" for electrical connections.

3.3 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Test each [**pressure vacuum breaker**] [**reduced-pressure-principle backflow preventer**] [**double-check, backflow-prevention assembly**] [**and**] [**double-check, detector-assembly backflow preventer**] according to authorities having jurisdiction and the device's reference standard.

B. Domestic water piping specialties will be considered defective if they do not pass tests and inspections.

C. Prepare test and inspection reports.

3.4 ADJUSTING

A. Set field-adjustable pressure set points of water pressure-reducing valves.

B. Set field-adjustable flow set points of balancing valves.

C. Set field-adjustable temperature set points of temperature-actuated, water mixing valves.

END OF SECTION 221119

SECTION 220516

EXPANSION FITTINGS AND LOOPS FOR PLUMBING PIPING

PART 4 - GENERAL

4.1 SUMMARY

A. Section Includes:

1. Packless expansion joints.
2. Grooved-joint expansion joints.
3. Pipe loops and swing connections.
4. Alignment guides and anchors.

4.2 ACTION SUBMITTALS

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

4.3 INFORMATIONAL SUBMITTALS

A. Welding certificates.

B. Product certificates.

4.4 CLOSEOUT SUBMITTALS

A. Maintenance data.

PART 5 - PRODUCTS

5.1 PACKLESS EXPANSION JOINTS

A. Packless Expansion Joints:
   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. Flex-Hose Co., Inc.
      b. Flexicraft Industries.
      c. Flex Pression Ltd.
      d. Metraflex, Inc.
      e. Unisource Manufacturing, Inc.

   2. Standards: ASTM F 1120 and EJMA's "Standards of the Expansion Joint Manufacturers Association, Inc."

5.2 GROOVED-JOINT EXPANSION JOINTS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   1. Anvil International, Inc.
   2. Shurjoint Piping Products.
   3. Victaulic Company.

B. Description: Factory-assembled expansion joint made of several grooved-end pipe nipples, couplings, and grooved joints.

C. Standard: AWWA C606, for grooved joints.

D. Nipples: ASTM A 53/A 53M, Schedule 40, Type E or S, steel pipe with grooved ends.

5.3 ALIGNMENT GUIDES AND ANCHORS

A. Alignment Guides:
   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. Adsco Manufacturing LLC.
      b. American BOA, Inc.
      c. Badger Industries, Inc.
      d. Expansion Joint Systems, Inc.
      e. Flex-Hose Co., Inc.
      f. Flexicraft Industries.
      g. Flex Pression Ltd.
      h. Flex-Weld, Inc.
      i. Flo Fab inc.

j. Hyspan Precision Products, Inc.
k. Metraflex, Inc.
l. Proco Products, Inc.
m. Senior Flexonics Pathway.
n. Tozen Corporation.
o. Unaflex.
p. Unisource Manufacturing, Inc.
q. Universal Metal Hose; a subsidiary of Hyspan Precision Products, Inc.
r. U.S. Bellows, Inc.
s. WahlcoMetroflex.

PART 6 - EXECUTION

6.1 EXPANSION-JOINT INSTALLATION

A. Install expansion joints of sizes matching sizes of piping in which they are installed.

B. Install metal-bellows expansion joints according to EJMA's "Standards of the Expansion Joint Manufacturers Association, Inc."

6.2 PIPE LOOP AND SWING CONNECTION INSTALLATION

A. Install pipe loops cold-sprung in tension or compression as required to partly absorb tension or compression produced during anticipated change in temperature.

B. Connect risers and branch connections to mains with at least five pipe fittings including tee in main.

C. Connect risers and branch connections to terminal units with at least four pipe fittings including tee in riser.

D. Connect mains and branch connections to terminal units with at least four pipe fittings including tee in main.

6.3 ALIGNMENT-GUIDE AND ANCHOR INSTALLATION

A. Install alignment guides to guide expansion and to avoid end-loading and torsional stress.

B. Install one guide(s) on each side of pipe expansion fittings and loops. Install guides nearest to expansion joint not more than four pipe diameters from expansion joint.

C. Attach guides to pipe and secure guides to building structure.

D. Install anchors at locations to prevent stresses from exceeding those permitted by ASME B31.9 and to prevent transfer of loading and stresses to connected equipment.

E. Anchor Attachments:

1. Anchor Attachment to Black-Steel Pipe: Attach by welding. Comply with ASME B31.9 and ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."
2. Anchor Attachment to Galvanized-Steel Pipe: Attach with pipe hangers. Use MSS SP-69, Type 42, riser clamp welded to anchor.
3. Anchor Attachment to Copper Tubing: Attach with pipe hangers. Use MSS SP-69, Type 24, U-bolts bolted to anchor.

F. Fabricate and install steel anchors by welding steel shapes, plates, and bars. Comply with ASME B31.9 and AWS D1.1/D1.1M.

1. Anchor Attachment to Steel Structural Members: Attach by welding.
2. Anchor Attachment to Concrete Structural Members: Attach by fasteners. Follow fastener manufacturer's written instructions.

G. Use grout to form flat bearing surfaces for guides and anchors attached to concrete.

END OF SECTION 220516

SECTION 221313

FACILITY SANITARY SEWERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Pipe and fittings.
2. Non pressure and pressure couplings.
3. Expansion joints.
4. Cleanouts.
5. Encasement for piping.
6. Manholes.

1.2 ACTION SUBMITTALS

A. Product Data: For expansion joints.

B. Shop Drawings: For manholes. Include plans, elevations, sections, details and frames and covers.

1.3 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Show pipe sizes, locations, and elevations. Show other piping in same trench and clearances from sewer system piping. Indicate interface and spatial relationship between manholes, piping, and proximate structures.

B. Product Certificates: For each type of cast-iron soil pipe and fitting, from manufacturer.

C. Field quality-control reports.

PART 2 - PRODUCTS

2.1 HUB-AND-SPIGOT, CAST-IRON SOIL PIPE AND FITTINGS

A. Pipe and Fittings: ASTM A 74, **Service class Service and Extra-Heavy classes**.

B. Gaskets: ASTM C 564, rubber.

C. Calking Materials: ASTM B 29, pure lead and oakum or hemp fiber.

2.2 HUBLESS CAST-IRON SOIL PIPE AND FITTINGS

A. Pipe and Fittings: ASTM A 888 or CISPI 301.

B. CISPI-Trademark, Shielded Couplings:

1. Description: ASTM C 1277 and CISPI 310, with stainless-steel corrugated shield; stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.

C. Heavy-Duty, Shielded Couplings:

1. Description: ASTM C 1277 and ASTM C 1540, with stainless-steel shield; stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.

2.3 PVC PIPE AND FITTINGS

A. PVC Corrugated Sewer Piping:

1. Pipe: ASTM F 949, PVC corrugated pipe with bell-and-spigot ends for gasketed joints.
2. Fittings: ASTM F 949, PVC molded or fabricated, socket type.
3. Gaskets: ASTM F 477, elastomeric seals.

B. PVC Type PSM Sewer Piping:

1. Pipe: ASTM D 3034, **SDR 35** , PVC Type PSM sewer pipe with bell-and-spigot ends for gasketed joints.
2. Fittings: ASTM D 3034, PVC with bell ends.
3. Gaskets: ASTM F 477, elastomeric seals.

2.4 NONPRESSURE-TYPE TRANSITION COUPLINGS

A. Comply with ASTM C 1173, elastomeric, sleeve-type, reducing or transition coupling, for joining underground nonpressure piping. Include ends of same sizes as piping to be joined and corrosion-resistant-metal tension band and tightening mechanism on each end.

B. Sleeve Materials:

1. For Cast-Iron Soil Pipes: ASTM C 564, rubber.
2. For Concrete Pipes: ASTM C 443 (ASTM C 443M), rubber.
3. For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
4. For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.

C. Unshielded, Flexible Couplings:

1. Description: Elastomeric sleeve with **stainless-steel shear ring and** corrosion-resistant-metal tension band and tightening mechanism on each end.

D. Ring-Type, Flexible Couplings: Elastomeric compression seal with dimensions to fit inside bell of larger pipe and for spigot of smaller pipe to fit inside ring.

2.5 EXPANSION JOINTS

A. Ductile-Iron, Flexible Expansion Joints:

1. Description: Compound fitting with combination of flanged and mechanical-joint ends complying with AWWA C110 or AWWA C153. Include two gasketed ball-joint sections and one or more gasketed sleeve sections, rated for 250-psig (1725-kPa) minimum working pressure and for offset and expansion indicated.

2.6 CLEANOUTS

A. Cast-Iron Cleanouts: ASME A112.36.2M, round, gray-iron housing with clamping device and round, secured, scoriated, gray-iron cover. Include gray-iron ferrule with inside calk or spigot connection and countersunk, tapered-thread, brass closure plug.

1. Top-Loading Classification(s): **Light Duty Medium Duty Heavy Duty Extra-Heavy Duty**.
2. Sewer Pipe Fitting and Riser to Cleanout: ASTM A 74, Service class, cast-iron soil pipe and fittings.

2.7 ENCASEMENT FOR PIPING

A. Standard: ASTM A 674 or AWWA C105.

B. Material: **Linear low-density polyethylene film of 0.008-inch (0.20-mm)**] **or high-density, cross-laminated polyethylene film of 0.004-inch (0.10-mm)**] minimum thickness.

C. Form: **Sheet or tube**.

D. Color: **Black**.

2.8 CONCRETE

A. General: Cast-in-place concrete complying with ACI 318, ACI 350/350R (ACI 350M/350RM), and the following:

1. Cement: ASTM C 150, Type II.
2. Fine Aggregate: ASTM C 33, sand.
3. Coarse Aggregate: ASTM C 33, crushed gravel.
4. Water: Potable.

B. Portland Cement Design Mix: 4000 psi (27.6 MPa) minimum, with 0.45 maximum water/cementitious materials ratio.

1. Reinforcing Fabric: ASTM A 185/A 185M, steel, welded wire fabric, plain.
2. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (420 MPa) deformed steel.

C. Manhole Channels and Benches: Factory or field formed from concrete. Portland cement design mix, 4000 psi (27.6 MPa) minimum, with 0.45 maximum water/cementitious materials ratio. Include channels and benches in manholes.

1. Channels: Concrete invert, formed to same width as connected piping, with height of vertical sides to three-fourths of pipe diameter. Form curved channels with smooth, uniform radius and slope.

a. Invert Slope: [**1**] [**2**] percent through manhole.

2. Benches: Concrete, sloped to drain into channel.

a. Slope: [**4**] [**8**] percent.

D. Ballast and Pipe Supports: Portland cement design mix, 3000 psi (20.7 MPa) minimum, with 0.58 maximum water/cementitious materials ratio.

1. Reinforcing Fabric: ASTM A 185/A 185M, steel, welded wire fabric, plain.
2. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (420 MPa) deformed steel.

PART 3 - EXECUTION

3.1 EARTHWORK

A. Excavating, trenching, and backfilling are specified in Section 312000 "Earth Moving."

3.2 PIPING INSTALLATION

A. General Locations and Arrangements: Drawing plans and details indicate general location and arrangement of underground sanitary sewer piping. Location and arrangement of piping layout take into account design considerations. Install piping as indicated, to extent practical. Where specific installation is not indicated, follow piping manufacturer's written instructions.

B. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions for using lubricants, cements, and other installation requirements.

C. Install manholes for changes in direction unless fittings are indicated. Use fittings for branch connections unless direct tap into existing sewer is indicated.

D. Install proper size increasers, reducers, and couplings where different sizes or materials of pipes and fittings are connected. Reducing size of piping in direction of flow is prohibited.

E. When installing pipe under streets or other obstructions that cannot be disturbed, use pipe-jacking process of microtunneling.

F. Install gravity-flow, nonpressure, drainage piping according to the following:

1. Install piping pitched down in direction of flow, at minimum slope of **2** percent unless otherwise indicated.
2. Install piping **NPS 6 (DN 150)** and larger with restrained joints at tee fittings and at changes in direction. Use corrosion-resistant rods, pipe or fitting manufacturer's proprietary restraint system, or cast-in-place-concrete supports or anchors.
3. Install piping with [**36-inch (915-mm)**] [**48-inch (1220-mm)**] [**60-inch (1520-mm)**] [**72-inch (1830-mm)**] <**Insert dimension**> minimum cover.
4. Install hub-and-spigot, cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook."
5. Install hubless cast-iron soil piping according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook."
6. Install PVC corrugated sewer piping according to ASTM D 2321 and ASTM F 1668.
7. Install PVC Type PSM sewer piping according to ASTM D 2321 and ASTM F 1668.
8. Install nonreinforced-concrete sewer piping according to ASTM C 1479 and ACPA's "Concrete Pipe Installation Manual."
9. Install reinforced-concrete sewer piping according to ASTM C 1479 and ACPA's "Concrete Pipe Installation Manual."

G. Install corrosion-protection piping encasement over the following underground metal piping according to ASTM A 674 or AWWA C105:

1. Hub-and-spigot, cast-iron soil pipe.
2. Hubless cast-iron soil pipe and fittings.
3. Expansion joints.

H. Clear interior of piping and manholes of dirt and superfluous material as work progresses. Maintain swab or drag in piping, and pull past each joint as it is completed. Place plug in end of incomplete piping at end of day and when work stops.

3.3 PIPE JOINT CONSTRUCTION

A. Join gravity-flow, nonpressure, drainage piping according to the following:

1. Join hub-and-spigot, cast-iron soil piping with gasket joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.
2. Join hub-and-spigot, cast-iron soil piping with calked joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for lead and oakum calked joints.

3. Join hubless cast-iron soil piping according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-coupling joints.
4. Join PVC corrugated sewer piping according to ASTM D 2321.
5. Join PVC Type PSM sewer piping according to ASTM D 2321 and ASTM D 3034 for elastomeric-seal joints or ASTM D 3034 for elastomeric-gasket joints.
6. Join nonreinforced-concrete sewer piping according to ASTM C 14 (ASTM C 14M) and ACPA's "Concrete Pipe Installation Manual" for rubber-gasket joints.
7. Join reinforced-concrete sewer piping according to ACPA's "Concrete Pipe Installation Manual" for rubber-gasket joints.
8. Join dissimilar pipe materials with nonpressure-type, flexible[**or rigid**] couplings.

B. Pipe couplings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.

1. Use nonpressure flexible couplings where required to join gravity-flow, nonpressure sewer piping unless otherwise indicated.

    a. Unshielded flexible couplings for pipes of same or slightly different OD.
    b. Unshielded, increaser/reducer-pattern, flexible couplings for pipes with different OD.
    c. Ring-type flexible couplings for piping of different sizes where annular space between smaller piping's OD and larger piping's ID permits installation.

3.4 CONCRETE PLACEMENT

A. Place cast-in-place concrete according to ACI 318.

3.5 CLEANOUT INSTALLATION

A. Install cleanouts and riser extensions from sewer pipes to cleanouts at grade. Use cast-iron soil pipe fittings in sewer pipes at branches for cleanouts, and use cast-iron soil pipe for riser extensions to cleanouts. Install piping so cleanouts open in direction of flow in sewer pipe.

1. Use Light-Duty, top-loading classification cleanouts in [**earth or unpaved foot-traffic**] <**Insert other**> areas.
2. Use Medium-Duty, top-loading classification cleanouts in [**paved foot-traffic**] <**Insert other**> areas.
3. Use Heavy-Duty, top-loading classification cleanouts in [**vehicle-traffic service**] <**Insert other**> areas.
4. Use Extra-Heavy-Duty, top-loading classification cleanouts in [**roads**] <**Insert area**>.

B. Set cleanout frames and covers in earth in cast-in-place-concrete block, [**18 by 18 by 12 inches (450 by 450 by 300 mm)**] <**Insert dimensions**> deep. Set with tops [**1 inch (25 mm)**] <**Insert dimension**> above surrounding grade.

C. Set cleanout frames and covers in concrete pavement and roads with tops flush with pavement surface.

3.6 CONNECTIONS

A. Connect nonpressure, gravity-flow drainage piping to building's sanitary building drains specified in Section 221316 "Sanitary Waste and Vent Piping."

B. Make connections to existing piping and underground manholes.

1. Use commercially manufactured wye fittings for piping branch connections. Remove section of existing pipe, install wye fitting into existing piping, and encase entire wye fitting plus 6-inch (150-mm) overlap with not less than 6 inches (150 mm) of concrete with 28-day compressive strength of 3000 psi (20.7 MPa).
2. Make branch connections from side into existing piping, NPS 4 to NPS 20 (DN 100 to DN 500). Remove section of existing pipe, install wye fitting into existing piping, and encase entire wye with not less than 6 inches (150 mm) of concrete with 28-day compressive strength of 3000 psi (20.7 MPa).
3. Make branch connections from side into existing piping, NPS 21 (DN 525) or larger, or to underground manholes by cutting opening into existing unit large enough to allow 3 inches (76 mm) of concrete to be packed around entering connection. Cut end of connection pipe passing through pipe or structure wall to conform to shape of and be flush with inside wall unless otherwise indicated. On outside of pipe or manhole wall, encase entering connection in 6 inches (150 mm) of concrete for minimum length of 12 inches (300 mm) to provide additional support of collar from connection to undisturbed ground.

    a. Use concrete that will attain a minimum 28-day compressive strength of 3000 psi (20.7 MPa) unless otherwise indicated.
    b. Use epoxy-bonding compound as interface between new and existing concrete and piping materials.

4. Protect existing piping and manholes to prevent concrete or debris from entering while making tap connections. Remove debris or other extraneous material that may accumulate.

3.7 IDENTIFICATION

A. Materials and their installation are specified in Section 312000 "Earth Moving." Arrange for installation of green warning tapes directly over piping and at outside edges of underground manholes.

1. Use[**warning tape or**] detectable warning tape over ferrous piping.
2. Use detectable warning tape over nonferrous piping and over edges of underground manholes.

3.8 FIELD QUALITY CONTROL

A. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches (600 mm) of backfill is in place, and again at completion of Project.

1. Submit separate report for each system inspection.
2. Defects requiring correction include the following:

    a. Alignment: Less than full diameter of inside of pipe is visible between structures.
    b. Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 92.5 percent of piping diameter.
    c. Damage: Crushed, broken, cracked, or otherwise damaged piping.
    d. Infiltration: Water leakage into piping.
    e. Exfiltration: Water leakage from or around piping.

3. Replace defective piping using new materials, and repeat inspections until defects are within allowances specified.
4. Reinspect and repeat procedure until results are satisfactory.

B. Test new piping systems, and parts of existing systems that have been altered, extended, or repaired, for leaks and defects.

1. Do not enclose, cover, or put into service before inspection and approval.
2. Test completed piping systems according to requirements of authorities having jurisdiction.
3. Schedule tests and inspections by authorities having jurisdiction with at least 24 hours' advance notice.
4. Submit separate report for each test.
5. Hydrostatic Tests: Test sanitary sewerage according to requirements of authorities having jurisdiction and the following:

    a. Fill sewer piping with water. Test with pressure of at least 10-foot (3-m) head of water, and maintain such pressure without leakage for at least 15 minutes.
    b. Close openings in system and fill with water.
    c. Purge air and refill with water.
    d. Disconnect water supply.
    e. Test and inspect joints for leaks.

6. Air Tests: Test sanitary sewerage according to requirements of authorities having jurisdiction, UNI-B-6, and the following:

    a. Option: Test plastic gravity sewer piping according to ASTM F 1417.
    b. Option: Test concrete gravity sewer piping according to ASTM C 924 (ASTM C 924M).

7. Manholes: Perform hydraulic test according to ASTM C 969 (ASTM C 969M).

C. Leaks and loss in test pressure constitute defects that must be repaired.

D. Replace leaking piping using new materials, and repeat testing until leakage is within allowances specified.

3.9 CLEANING

A. Clean dirt and superfluous material from interior of piping.[**Flush with potable water.**]

END OF SECTION 221313

SECTION 221316

SANITARY WASTE AND VENT PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Pipe, tube, and fittings.
2. Specialty pipe fittings.

B. Related Section:

1. Section 221313 "Facility Sanitary Sewers" for sanitary sewerage piping and structures outside the building.

1.2 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Soil, waste, and vent piping and support and installation shall withstand the effects of earthquake motions determined according to **ASCE/SEI 7**

1.3 ACTION SUBMITTALS

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

B. LEED Submittals:

1. Product Data for Credit IEQ 4.1: For solvent cements and adhesive primers, documentation including printed statement of VOC content.
2. Laboratory Test Reports for Credit IEQ 4: For solvent cements and adhesive primers, documentation indicating that products comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

1.4 INFORMATIONAL SUBMITTALS

A. Seismic Qualification Certificates: For waste and vent piping, accessories, and components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.

2. Detailed description of piping anchorage devices on which the certification is based and their installation requirements.

B. Field quality-control reports.

1.5 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

B. Comply with NSF/ANSI 14, "Plastics Piping Systems Components and Related Materials," for plastic piping components. Include marking with "NSF-dwv" for plastic drain, waste, and vent piping and "NSF-sewer" for plastic sewer piping.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

2.2 HUB-AND-SPIGOT, CAST-IRON SOIL PIPE AND FITTINGS

A. Pipe and Fittings: ASTM A 74,**Service** class.

B. Gaskets: ASTM C 564, rubber.

2.3 HUBLESS, CAST-IRON SOIL PIPE AND FITTINGS

A. Pipe and Fittings: ASTM A 888 or CISPI 301.

B. CISPI, Hubless-Piping Couplings:

1. Standards: ASTM C 1277 and CISPI 310.
2. Description: Stainless-steel corrugated shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.

C. Heavy-Duty, Hubless-Piping Couplings:

1. Standards: ASTM C 1277 and ASTM C 1540.
2. Description: Stainless-steel shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.

2.4 COPPER TUBE AND FITTINGS

A. Copper DWV Tube: ASTM B 306, drainage tube, drawn temper.

B. Copper Drainage Fittings: ASME B16.23, cast copper or ASME B16.29, wrought copper, solder-joint fittings.

C. Copper Flanges: ASME B16.24, Class 150, cast copper with solder-joint end.

1. Flange Gasket Materials: ASME B16.21, full-face, flat, nonmetallic, asbestos-free, 1/8-inch (3.2-mm) maximum thickness unless thickness or specific material is indicated.
2. Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.

D. Solder: ASTM B 32, lead free with ASTM B 813, water-flushable flux.

2.5 ABS PIPE AND FITTINGS

A. Solid-Wall ABS Pipe: ASTM D 2661, Schedule 40.

B. Cellular-Core ABS Pipe: ASTM F 628, Schedule 40.

C. ABS Socket Fittings: ASTM D 2661, made to ASTM D 3311, drain, waste, and vent patterns.

D. Solvent Cement: ASTM D 2235.

1. ABS solvent cement shall have a VOC content of 325 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. Solvent cement shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.6 PVC PIPE AND FITTINGS

A. Solid-Wall PVC Pipe: ASTM D 2665, drain, waste, and vent.

B. Cellular-Core PVC Pipe: ASTM F 891, Schedule 40.

C. PVC Socket Fittings: ASTM D 2665, made to ASTM D 3311, drain, waste, and vent patterns and to fit Schedule 40 pipe.

D. Adhesive Primer: ASTM F 656.

1. Adhesive primer shall have a VOC content of 550 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. Adhesive primer shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of

Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

E. Solvent Cement: ASTM D 2564.

1. PVC solvent cement shall have a VOC content of 510 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. Solvent cement shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.7 SPECIALTY PIPE FITTINGS

A. Transition Couplings:

1. General Requirements: Fitting or device for joining piping with small differences in OD's or of different materials. Include end connections same size as and compatible with pipes to be joined.
2. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.
3. Unshielded, Nonpressure Transition Couplings:

    a. Standard: ASTM C 1173.
    b. Description: Elastomeric, sleeve-type, reducing or transition pattern. Include shear ring and corrosion-resistant-metal tension band and tightening mechanism on each end.
    c. Sleeve Materials:

        1) For Cast-Iron Soil Pipes: ASTM C 564, rubber.
        2) For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
        3) For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.

4. Shielded, Nonpressure Transition Couplings:

    a. Standard: ASTM C 1460.
    b. Description: Elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.

PART 3 - EXECUTION

3.1 EARTH MOVING

A. Comply with requirements for excavating, trenching, and backfilling specified in Section 312000 "Earth Moving."

3.2 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.

B. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

E. Install piping at indicated slopes.

F. Install piping free of sags and bends.

G. Install fittings for changes in direction and branch connections.

H. Install seismic restraints on piping. Comply with requirements for seismic-restraint devices specified in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."

I. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical. Use long-turn, double Y-branch and 1/8-bend fittings if two fixtures are installed back to back or side by side with common drain pipe. Straight tees, elbows, and crosses may be used on vent lines. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.

J. Lay buried building drainage piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.

K. Install soil and waste drainage and vent piping at the following minimum slopes unless otherwise indicated:

1. Building Sanitary Drain: 2 percent downward in direction of flow for piping NPS 3 (DN 80) and smaller; **2 percent** downward in direction of flow for piping NPS 4 (DN 100) and larger.
2. Horizontal Sanitary Drainage Piping: **2 percent** downward in direction of flow.
3. Vent Piping: **1 percent** down toward vertical fixture vent or toward vent stack.

L. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."

M. Install aboveground copper tubing according to CDA's "Copper Tube Handbook."

N. Install aboveground ABS piping according to ASTM D 2661.

O. Install aboveground PVC piping according to ASTM D 2665.

P. Install underground **ABS and PVC** piping according to ASTM D 2321.

Q. Plumbing Specialties:

1. Install backwater valves in sanitary waste gravity-flow piping. Comply with requirements for backwater valves specified in Section 221319 "Sanitary Waste Piping Specialties."
2. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers in sanitary drainage gravity-flow piping. Comply with requirements for cleanouts specified in Section 221319 "Sanitary Waste Piping Specialties."
3. Install drains in sanitary drainage gravity-flow piping. Comply with requirements for drains specified in Section 221319 "Sanitary Waste Piping Specialties."

R. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

S. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."

T. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."

U. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 220518 "Escutcheons for Plumbing Piping."

3.3 JOINT CONSTRUCTION

A. Join hub-and-spigot, cast-iron soil piping with gasket joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.

B. Join hubless, cast-iron soil piping according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-piping coupling joints.

C. Join copper tube and fittings with soldered joints according to ASTM B 828. Use ASTM B 813, water-flushable, lead-free flux and ASTM B 32, lead-free-alloy solder.

D. Flanged Joints: Align bolt holes. Select appropriate gasket material, size, type, and thickness. Install gasket concentrically positioned. Use suitable lubricants on bolt threads. Torque bolts in cross pattern.

E. Plastic, Nonpressure-Piping, Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:

1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
2. ABS Piping: Join according to ASTM D 2235 and ASTM D 2661 Appendixes.
3. PVC Piping: Join according to ASTM D 2855 and ASTM D 2665 Appendixes.

3.4 SPECIALTY PIPE FITTING INSTALLATION

A. Transition Couplings:

1. Install transition couplings at joints of piping with small differences in OD's.
2. In Drainage Piping: **Unshielded Shielded**, nonpressure transition couplings.

3.5 VALVE INSTALLATION

A. Backwater Valves: Install backwater valves in piping subject to backflow.

1. Horizontal Piping: Horizontal backwater valves. **Use normally closed type unless otherwise indicated.**
2. Floor Drains: Drain outlet backwater valves unless drain has integral backwater valve.
3. Install backwater valves in accessible locations.
4. Comply with requirements for backwater valve specified in Section 221319 "Sanitary Waste Piping Specialties."

3.6 HANGER AND SUPPORT INSTALLATION

A. Comply with requirements for seismic-restraint devices specified in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."

B. Comply with requirements for pipe hanger and support devices and installation specified in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."

1. Install **carbon-steel** pipe hangers for horizontal piping in noncorrosive environments.
2. Install **stainless-steel** pipe hangers for horizontal piping in corrosive environments.
3. Install **carbon-steel** pipe support clamps for vertical piping in noncorrosive environments.
4. Install stainless-steel pipe support clamps for vertical piping in corrosive environments.

5. Vertical Piping: MSS Type 8 or Type 42, clamps.
6. Install individual, straight, horizontal piping runs:

    a. 100 Feet (30 m) and Less: MSS Type 1, adjustable, steel clevis hangers.
    b. Longer Than 100 Feet (30 m): MSS Type 43, adjustable roller hangers.
    c. Longer Than 100 Feet (30 m) if Indicated: MSS Type 49, spring cushion rolls.

7. Multiple, Straight, Horizontal Piping Runs 100 Feet (30 m) or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
8. Base of Vertical Piping: MSS Type 52, spring hangers.

C. Support horizontal piping and tubing within 12 inches (300 mm) of each fitting[**, valve,**] and coupling.

D. Support vertical piping and tubing at base and at each floor.

E. Rod diameter may be reduced one size for double-rod hangers, with 3/8-inch (10-mm) minimum rods.

F. Install hangers for cast-iron soil piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/2 and NPS 2 (DN 40 and DN 50): 60 inches (1500 mm) with 3/8-inch (10-mm) rod.
2. NPS 3 (DN 80): 60 inches (1500 mm) with 1/2-inch (13-mm) rod.
3. NPS 4 and NPS 5 (DN 100 and DN 125): 60 inches (1500 mm) with 5/8-inch (16-mm) rod.
4. NPS 6 and NPS 8 (DN 150 and DN 200): 60 inches (1500 mm) with 3/4-inch (19-mm) rod.
5. Spacing for 10-foot (3-m) lengths may be increased to 10 feet (3 m). Spacing for fittings is limited to 60 inches (1500 mm).

G. Install supports for vertical cast-iron soil piping every 15 feet (4.5 m).

H. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/4 (DN 32): 72 inches (1800 mm) with 3/8-inch (10-mm) rod.
2. NPS 1-1/2 and NPS 2 (DN 40 and DN 50): 96 inches (2400 mm) with 3/8-inch (10-mm) rod.
3. NPS 2-1/2 (DN 65): 108 inches (2700 mm) with 1/2-inch (13-mm) rod.
4. NPS 3 and NPS 5 (DN 80 and DN 125): 10 feet (3 m) with 1/2-inch (13-mm) rod.
5. NPS 6 (DN 150): 10 feet (3 m) with 5/8-inch (16-mm) rod.
6. NPS 8 (DN 200): 10 feet (3 m) with 3/4-inch (19-mm) rod.

I. Install supports for vertical copper tubing every 10 feet (3 m).

J. Install hangers for [**ABS**] [**and**] [**PVC**] piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/2 and NPS 2 (DN 40 and DN 50): 48 inches (1200 mm) with 3/8-inch (10-mm) rod.
2. NPS 3 (DN 80): 48 inches (1200 mm) with 1/2-inch (13-mm) rod.
3. NPS 4 and NPS 5 (DN 100 and DN 125): 48 inches (1200 mm) with 5/8-inch (16-mm) rod.
4. NPS 6 and NPS 8 (DN 150 and DN 200): 48 inches (1200 mm) with 3/4-inch (19-mm) rod.

K. Install supports for vertical **ABS and PVC** piping every 48 inches (1200 mm).

L. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

3.7 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect soil and waste piping to exterior sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.

C. Connect drainage and vent piping to the following:

1. Plumbing Fixtures: Connect drainage piping in sizes indicated, but not smaller than required by plumbing code.
2. Plumbing Fixtures and Equipment: Connect atmospheric vent piping in sizes indicated, but not smaller than required by authorities having jurisdiction.
3. Plumbing Specialties: Connect drainage and vent piping in sizes indicated, but not smaller than required by plumbing code.
4. Install test tees (wall cleanouts) in conductors near floor and floor cleanouts with cover flush with floor.
5. Install horizontal backwater valves **with cleanout cover flush with floor**.
6. Comply with requirements for **backwater valves cleanouts and drains** specified in Section 221319 "Sanitary Waste Piping Specialties."
7. Equipment: Connect drainage piping as indicated. Provide shutoff valve if indicated and union for each connection. Use flanges instead of unions for connections NPS 2-1/2 (DN 65) and larger.

D. Where installing piping adjacent to equipment, allow space for service and maintenance of equipment.

E. Make connections according to the following unless otherwise indicated:

1. Install unions, in piping NPS 2 (DN 50) and smaller, adjacent to each valve and at final connection to each piece of equipment.
2. Install flanges, in piping NPS 2-1/2 (DN 65) and larger, adjacent to flanged valves and at final connection to each piece of equipment.

3.8 IDENTIFICATION

A. Identify exposed sanitary waste and vent piping. Comply with requirements for identification specified in Section 220553 "Identification for Plumbing Piping and Equipment."

3.9 FIELD QUALITY CONTROL

A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.

1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.

B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.

C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

D. Test sanitary drainage and vent piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:

1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
2. Leave uncovered and unconcealed new, altered, extended, or replaced drainage and vent piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
3. Roughing-in Plumbing Test Procedure: Test drainage and vent piping except outside leaders on completion of roughing-in. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water (30 kPa). From 15 minutes before inspection starts to completion of inspection, water level must not drop. Inspect joints for leaks.
4. Finished Plumbing Test Procedure: After plumbing fixtures have been set and traps filled with water, test connections and prove they are gastight and watertight. Plug vent-stack openings on roof and building drains where they leave building. Introduce air into piping system equal to pressure of 1-inch wg (250 Pa). Use U-tube or manometer inserted in trap of water closet to measure this pressure. Air pressure must remain constant without introducing additional air throughout period of inspection. Inspect plumbing fixture connections for gas and water leaks.
5. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
6. Prepare reports for tests and required corrective action.

3.10 CLEANING AND PROTECTION

A. Clean interior of piping. Remove dirt and debris as work progresses.

B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.

C. Place plugs in ends of uncompleted piping at end of day and when work stops.

D. Exposed **ABS and PVC** Piping: Protect plumbing vents exposed to sunlight with two coats of water-based latex paint.

3.11 PIPING SCHEDULE

A. Flanges and unions may be used on aboveground pressure piping unless otherwise indicated.

B. Aboveground, soil and waste piping **NPS 4 (DN 100) and smaller** shall be **any of** the following:

1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
2. Hubless, cast-iron soil pipe and fittings; **CISPI heavy-duty** hubless-piping couplings; and coupled joints.
3. Copper DWV tube, copper drainage fittings, and soldered joints.
4. **Solid-wall** ABS pipe, ABS socket fittings, and solvent-cemented joints.
5. **Solid-wall** PVC pipe, PVC socket fittings, and solvent-cemented joints.
6. Dissimilar Pipe-Material Couplings: s**hielded**, nonpressure transition couplings.

C. Aboveground, soil and waste piping **NPS 5 (DN 125) and larger** shall be **any of** the following:

1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
2. Hubless, cast-iron soil pipe and fittings; **CISPI heavy-duty** hubless-piping couplings; and coupled joints.
3. **Solid-wall** PVC pipe, PVC socket fittings, and solvent-cemented joints.
4. Dissimilar Pipe-Material Couplings: **Shielded**, nonpressure transition couplings.

D. Aboveground, vent piping **NPS 4 (DN 100) and smaller** shall be **any of** the following:

1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
2. Hubless, cast-iron soil pipe and fittings; **CISPI heavy-duty** hubless-piping couplings; and coupled joints.
3. Copper DWV tube, copper drainage fittings, and soldered joints.
4. **Solid-wall** ABS pipe, ABS socket fittings, and solvent-cemented joints.
5. **Solid-wall** PVC pipe, PVC socket fittings, and solvent-cemented joints.
6. Dissimilar Pipe-Material Couplings: **Shielded**, non-pressure transition couplings.

E. Aboveground, vent piping **NPS 5 (DN 125) and larger** shall be **any of** the following:

1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.

2. Hubless, cast-iron soil pipe and fittings; **CISPI heavy-duty** hubless-piping couplings; and coupled joints.
3. **Solid-wall** PVC pipe, PVC socket fittings, and solvent-cemented joints.
4. Dissimilar Pipe-Material Couplings: **Shielded**, non-pressure transition couplings.

F. Underground, soil, waste, and vent piping **NPS 4 (DN 100) and smaller**] <**Insert pipe size range**> shall be[**any of**] the following:

1. **Service** class, cast-iron soil piping; **gaskets; and gasketed** joints.
2. Hubless, cast-iron soil pipe and fittings; **CISPI heavy-duty cast-iron** hubless-piping couplings; and coupled joints.
3. **Solid wall** ABS pipe, ABS socket fittings, and solvent-cemented joints.
4. **Solid wall** PVC pipe, PVC socket fittings, and solvent-cemented joints.
5. Dissimilar Pipe-Material Couplings: **Shielded**, non-pressure transition couplings.

G. Underground, soil and waste piping **NPS 5 (DN 125) and larger** shall be **any of** the following:

1. **Service** class, cast-iron soil piping; **gaskets; and gasketed** joints.
2. Hubless, cast-iron soil pipe and fittings; **CISPI heavy-duty cast-iron** hubless-piping couplings; coupled joints.
3. **Solid-wall** PVC pipe; PVC socket fittings; and solvent-cemented joints.
4. Dissimilar Pipe-Material Couplings: **Shielded**, non-pressure transition couplings.

END OF SECTION 221316

SECTION 221319

SANITARY WASTE PIPING SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Backwater valves.
2. Cleanouts.
3. Floor drains.
4. Roof flashing assemblies.
5. Miscellaneous sanitary drainage piping specialties.
6. Flashing materials.

1.2 QUALITY ASSURANCE

A. Drainage piping specialties shall bear label, stamp, or other markings of specified testing agency.

PART 2 - PRODUCTS

2.1 CLEANOUTS

A. Exposed Cast-Iron Cleanouts :

1. Standard: [**ASME A112.36.2M for cast iron**] for cleanout test tee.
2. Size: Same as connected drainage piping
3. Body Material: [**Hub-and-spigot, cast-iron soil pipe T-branch**] [**Hubless, cast-iron soil pipe test tee**] as required to match connected piping.
4. Closure: [**Countersunk**] [**Countersunk or raised-head**] [**Raised-head**], [**brass**] [**cast-iron**] [**plastic**] plug.
5. Closure Plug Size: Same as or not more than one size smaller than cleanout size.

B. Cast-Iron Floor Cleanouts :

1. Standard: ASME A112.36.2M for [**adjustable housing**] [**cast-iron soil pipe with cast-iron ferrule**] [**heavy-duty, adjustable housing**] [**threaded, adjustable housing**] cleanout.
2. Size: Same as connected branch.
3. Type: **Adjustable housing**] [**Cast-iron soil pipe with cast-iron ferrule**] [**Heavy-duty, adjustable housing**] [**Threaded, adjustable housing**].

4. Body or Ferrule: [**Cast iron**] <**Insert material**>.
5. Adjustable Housing Material: **Cast iron Plastic material**> with **threads set-screws or other device**].
6. Frame and Cover Material and Finish: [**ickel-bronze, copper alloy** .
7. Frame and Cover Shape: **Round**.
8. Top Loading Classification: **Medium** Duty.
9. Riser: ASTM A 74, **Service** class, cast-iron drainage pipe fitting and riser to cleanout.

C. Cast-Iron Wall Cleanouts :

1. Standard: ASME A112.36.2M. Include wall access.
2. Size: Same as connected drainage piping.
3. Body: [**Hub-and-spigot, cast-iron soil pipe T-branch**] [**Hubless, cast-iron soil pipe test tee**] as required to match connected piping.
4. Closure: [**Countersunk**] [**Countersunk or raised-head**] [**Raised-head**], [**drilled-and-threaded**] [**brass**] [**cast-iron**] plug.
5. Closure Plug Size: Same as or not more than one size smaller than cleanout size.
6. Wall Access: Round, [**deep, chrome-plated bronze**] [**flat, chrome-plated brass or stainless-steel**] cover plate with screw.
7. Wall Access: [**Round**] [**Square**], [**nickel-bronze, copper-alloy, or stainless-steel**] <**Insert material**> wall-installation frame and cover.

2.2 FLOOR DRAINS

A. Cast-Iron Floor Drains :

1. Standard: ASME A112.6.3 **with backwater valve**.
2. Pattern:**Sanitary** drain.
3. Body Material: [**Gray iron**
4. Outlet: [**Bottom**] .
5. Top or Strainer Material: [**Bronze**] [**Gray iron**] [**Nickel bronze**].
6. Top of Body and Strainer Finish: [**Nickel bronze**].
7. Top Shape: **Round**.
8. Dimensions of Top or Strainer:

2.3 ROOF FLASHING ASSEMBLIES

A. Roof Flashing Assemblies :

1. Description: Manufactured assembly made of [**4.0-lb/sq. ft. (20-kg/sq. m), 0.0625-inch- (1.6-mm-)**] [**6.0-lb/sq. ft. (30-kg/sq. m), 0.0938-inch- (2.4-mm-)**] thick, lead flashing collar and skirt extending at least [**6 inches (150 mm)**] [**8 inches (200 mm)**] [**10 inches (250 mm)**] from pipe, with galvanized-steel boot reinforcement and counterflashing fitting.

    a. Open-Top Vent Cap: Without cap.
    b. Low-Silhouette Vent Cap: With vandal-proof vent cap.

c. Extended Vent Cap: With field-installed, vandal-proof vent cap.

2.4 MISCELLANEOUS SANITARY DRAINAGE PIPING SPECIALTIES

A. Floor-Drain, Trap-Seal Primer Fittings :

1. Description: Cast iron, with threaded inlet and threaded or spigot outlet, and trap-seal primer valve connection.
2. Size: Same as floor drain outlet with NPS 1/2 (DN 15) side inlet.

B. Air-Gap Fittings :

1. Standard: ASME A112.1.2, for fitting designed to ensure fixed, positive air gap between installed inlet and outlet piping.
2. Body: Bronze or cast iron.
3. Inlet: Opening in top of body.
4. Outlet: Larger than inlet.
5. Size: Same as connected waste piping and with inlet large enough for associated indirect waste piping.

C. Sleeve Flashing Device

1. Description: Manufactured, cast-iron fitting, with clamping device, that forms sleeve for pipe floor penetrations of floor membrane. Include galvanized-steel pipe extension in top of fitting that will extend [**1 inch (25 mm)**] [**2 inches (51 mm)**] <**Insert dimension**> above finished floor and galvanized-steel pipe extension in bottom of fitting that will extend through floor slab.
2. Size: As required for close fit to riser or stack piping.

D. Vent Caps :

1. Description: Cast-iron body with threaded or hub inlet and vandal-proof design. Include vented hood and setscrews to secure to vent pipe.
2. Size: Same as connected stack vent or vent stack.

2.5 FLASHING MATERIALS

A. Lead Sheet: ASTM B 749, Type L51121, copper bearing, with the following minimum weights and thicknesses, unless otherwise indicated:

1. General Use: 4.0-lb/sq. ft. (20-kg/sq. m), 0.0625-inch (1.6-mm) thickness.
2. Vent Pipe Flashing: 3.0-lb/sq. ft. (15-kg/sq. m), 0.0469-inch (1.2-mm) thickness.
3. Burning: 6-lb/sq. ft. (30-kg/sq. m), 0.0938-inch (2.4-mm) thickness.

B. Fasteners: Metal compatible with material and substrate being fastened.

C. Metal Accessories: Sheet metal strips, clamps, anchoring devices, and similar accessory units required for installation; matching or compatible with material being installed.

D. Solder: ASTM B 32, lead-free alloy.

E. Bituminous Coating: SSPC-Paint 12, solvent-type, bituminous mastic.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install backwater valves in building drain piping. For interior installation, provide cleanout deck plate flush with floor and centered over backwater valve cover, and of adequate size to remove valve cover for servicing.

B. Install cleanouts in aboveground piping and building drain piping according to the following, unless otherwise indicated:

1. Size same as drainage piping up to NPS 4 (DN 100). Use NPS 4 (DN 100) for larger drainage piping unless larger cleanout is indicated.
2. Locate at each change in direction of piping greater than 45 degrees.
3. Locate at minimum intervals of 50 feet (15 m) for piping NPS 4 (DN 100) and smaller and 100 feet (30 m) for larger piping.
4. Locate at base of each vertical soil and waste stack.

C. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.

D. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.

E. Install floor drains at low points of surface areas to be drained. Set grates of drains flush with finished floor, unless otherwise indicated.

1. Position floor drains for easy access and maintenance.
2. Set floor drains below elevation of surrounding finished floor to allow floor drainage. Set with grates depressed according to the following drainage area radii:

    a. Radius, 30 Inches (750 mm) or Less: Equivalent to 1 percent slope, but not less than 1/4-inch (6.35-mm) total depression.
    b. Radius, 30 to 60 Inches (750 to 1500 mm): Equivalent to 1 percent slope.
    c. Radius, 60 Inches (1500 mm) or Larger: Equivalent to 1 percent slope, but not greater than 1-inch (25-mm) total depression.

3. Install floor-drain flashing collar or flange so no leakage occurs between drain and adjoining flooring. Maintain integrity of waterproof membranes where penetrated.
4. Install individual traps for floor drains connected to sanitary building drain, unless otherwise indicated.

F. Install roof flashing assemblies on sanitary stack vents and vent stacks that extend through roof.

G. Install flashing fittings on sanitary stack vents and vent stacks that extend through roof.

H. Install deep-seal traps on floor drains and other waste outlets, if indicated.

I. Install floor-drain, trap-seal primer fittings on inlet to floor drains that require trap-seal primer connection.

1. Exception: Fitting may be omitted if trap has trap-seal primer connection.
2. Size: Same as floor drain inlet.

J. Install air-gap fittings on draining-type backflow preventers and on indirect-waste piping discharge into sanitary drainage system.

K. Install sleeve flashing device with each riser and stack passing through floors with waterproof membrane.

L. Install vent caps on each vent pipe passing through roof.

M. Install traps on plumbing specialty drain outlets. Omit traps on indirect wastes unless trap is indicated.

3.2 CONNECTIONS

A. Comply with requirements in Section 221316 "Sanitary Waste and Vent Piping" for piping installation requirements. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to equipment to allow service and maintenance.

3.3 FLASHING INSTALLATION

A. Fabricate flashing from single piece unless large pans, sumps, or other drainage shapes are required. Join flashing according to the following if required:

1. Lead Sheets: Burn joints of lead sheets 6.0-lb/sq. ft. (30-kg/sq. m), 0.0938-inch (2.4-mm) thickness or thicker. Solder joints of lead sheets 4.0-lb/sq. ft. (20-kg/sq. m), 0.0625-inch (1.6-mm) thickness or thinner.

B. Install sheet flashing on pipes, sleeves, and specialties passing through or embedded in floors and roofs with waterproof membrane.

1. Pipe Flashing: Sleeve type, matching pipe size, with minimum length of 10 inches (250 mm), and skirt or flange extending at least 8 inches (200 mm) around pipe.
2. Sleeve Flashing: Flat sheet, with skirt or flange extending at least 8 inches (200 mm) around sleeve.

3. Embedded Specialty Flashing: Flat sheet, with skirt or flange extending at least 8 inches (200 mm) around specialty.

C. Set flashing on floors and roofs in solid coating of bituminous cement.

D. Secure flashing into sleeve and specialty clamping ring or device.

E. Install flashing for piping passing through roofs with counterflashing or commercially made flashing fittings, according to Section 076200 "Sheet Metal Flashing and Trim."

F. Extend flashing up vent pipe passing through roofs and turn down into pipe, or secure flashing into cast-iron sleeve having calking recess.

3.4 LABELING AND IDENTIFYING

A. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplate or sign on or near each grease interceptor.

B. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit. Nameplates and signs are specified in Section 220553 "Identification for Plumbing Piping and Equipment."

3.5 PROTECTION

A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.

B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION 221319

SECTION 221413

FACILITY STORM DRAINAGE PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Pipe, tube, and fittings.
2. Specialty pipe fittings.

B. Related Section:

1. Section 334100 "Storm Utility Drainage Piping" for storm drainage piping outside the building.

1.2 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Storm drainage piping and support and installation shall withstand the effects of earthquake motions determined according to **ASCE/SEI 7** .

1.3 ACTION SUBMITTALS

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

B. LEED Submittals:

1. Product Data for Credit IEQ 4.1: For solvent cements and adhesive primers, documentation including printed statement of VOC content.
2. Laboratory Test Reports for Credit IEQ 4: For solvent cements and adhesive primers, documentation indicating that products comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

1.4 INFORMATIONAL SUBMITTALS

A. Seismic Qualification Certificates: For storm drainage piping, accessories, and components, from manufacturer.

B. Field quality-control reports.

1.5 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

B. Comply with NSF/ANSI 14, "Plastics Piping System Components and Related Materials," for plastic piping components. Include marking with "NSF-drain" for plastic drain piping and "NSF-sewer" for plastic sewer piping.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

2.2 HUB-AND-SPIGOT, CAST-IRON SOIL PIPE AND FITTINGS

A. Pipe and Fittings: ASTM A 74, Service class.

B. Gaskets: ASTM C 564, rubber.

2.3 HUBLESS, CAST-IRON SOIL PIPE AND FITTINGS

A. Pipe and Fittings: ASTM A 888 or CISPI 301.

B. CISPI, Hubless-Piping Couplings:

1. Standards: ASTM C 1277 and CISPI 310.
2. Description: Stainless-steel corrugated shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.

C. Heavy-Duty, Hubless-Piping Couplings:

1. Standards: ASTM C 1277 and ASTM C 1540.
2. Description: Stainless-steel shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.

2.4 COPPER TUBE AND FITTINGS

A. Copper DWV Tube: ASTM B 306, drainage tube, drawn temper.

B. Copper Drainage Fittings: ASME B16.23, cast-copper fittings or ASME B16.29, wrought-copper, solder-joint fittings.

C. Copper Flanges: ASME B16.24, Class 150, cast copper with solder-joint end.

1. Flange Gasket Materials: ASME B16.21, full-face, flat, nonmetallic, asbestos-free, 1/8-inch (3.2-mm) maximum thickness unless thickness or specific material is indicated.
2. Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.

D. Solder: ASTM B 32, lead free with ASTM B 813, water-flushable flux.

2.5 ABS PIPE AND FITTINGS

A. Solid-Wall ABS Pipe: ASTM D 2661, Schedule 40.

B. ABS Socket Fittings: ASTM D 2661, made to ASTM D 3311, drain, waste, and vent patterns.

C. Solvent Cement: ASTM D 2235.

1. ABS solvent cement shall have a VOC content of 325 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. Solvent cement shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.6 PVC PIPE AND FITTINGS

A. Solid-Wall PVC Pipe: ASTM D 2665, drain, waste, and vent.

B. PVC Socket Fittings: ASTM D 2665, made to ASTM D 3311, drain, waste, and vent patterns and to fit Schedule 40 pipe.

C. Adhesive Primer: ASTM F 656.

1. Adhesive primer shall have a VOC content of 550 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. Adhesive primer shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

D. Solvent Cement: ASTM D 2564.

1. PVC solvent cement shall have a VOC content of 510 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. Solvent cement shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.7 SPECIALTY PIPE FITTINGS

A. Transition Couplings:

1. General Requirements: Fitting or device for joining piping with small differences in OD's or of different materials. Include end connections same size as and compatible with pipes to be joined.
2. Fitting-Type Transition Couplings: Manufactured piping coupling or specified-piping-system fitting.
3. Unshielded, Nonpressure Transition Couplings:

a. Standard: ASTM C 1173.
b. Description: Elastomeric, sleeve-type, reducing or transition pattern. Include shear ring and corrosion-resistant-metal tension band and tightening mechanism on each end.
c. Sleeve Materials:

1) For Cast-Iron Soil Pipes: ASTM C 564, rubber.
2) For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
3) For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.

4. Shielded, Nonpressure Transition Couplings:

a. Standard: ASTM C 1460.
b. Description: Elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.

PART 3 - EXECUTION

3.1 EARTH MOVING

A. Comply with requirements for excavating, trenching, and backfilling specified in Section 312000 "Earth Moving."

3.2 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations from layout are approved on coordination drawings.

B. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

E. Install piping at indicated slopes.

F. Install piping free of sags and bends.

G. Install fittings for changes in direction and branch connections.

H. Install seismic restraints on piping. Comply with requirements for seismic-restraint devices specified in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."

I. Make changes in direction for storm drainage piping using appropriate branches, bends, and long-sweep bends. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.

J. Lay buried building storm drainage piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.

K. Install storm drainage piping at the following minimum slopes unless otherwise indicated:

1. Building Storm Drain: **2 percent** downward in direction of flow for piping NPS 3 (DN 80) and smaller; **2 percent** downward in direction of flow for piping NPS 4 (DN 100) and larger.
2. Horizontal Storm-Drainage Piping: **2 percent** downward in direction of flow.

L. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."

1. Install encasement on underground piping according to ASTM A 674 or AWWA C105.

M. Install aboveground copper tubing according to CDA's "Copper Tube Handbook."

N. Install aboveground ABS piping according to ASTM D 2661.

O. Install aboveground PVC piping according to ASTM D 2665.

P. Install underground **ABS and PVC** piping according to ASTM D 2321.

Q. Plumbing Specialties:

1. Install backwater valves in storm drainage gravity-flow piping. Comply with requirements for backwater valves specified in Section 221423 "Storm Drainage Piping Specialties."
2. Install cleanouts at grade and extend to where building storm drains connect to building storm sewers in storm drainage gravity-flow piping. Install cleanout fitting with closure plug inside the building in storm drainage force-main piping. Comply with requirements for cleanouts specified in Section 221423 "Storm Drainage Piping Specialties."
3. Install drains in storm drainage gravity-flow piping. Comply with requirements for drains specified in Section 221423 "Storm Drainage Piping Specialties."

R. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

S. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."

T. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."

U. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 220518 "Escutcheons for Plumbing Piping."

3.3 JOINT CONSTRUCTION

A. Join hub-and-spigot, cast-iron soil piping with gasketed joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.

B. Join hubless, cast-iron soil piping according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-piping coupling joints.

C. Join copper tube and fittings with soldered joints according to ASTM B 828 procedure. Use ASTM B 813, water-flushable, lead-free flux and ASTM B 32, lead-free-alloy solder.

D. Flanged Joints: Align bolt holes. Select appropriate gasket material, size, type, and thickness. Install gasket concentrically positioned. Use suitable lubricants on bolt threads. Torque bolts in cross pattern.

E. Plastic, Nonpressure-Piping, Solvent-Cemented Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:

1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
2. ABS Piping: Join according to ASTM D 2235 and ASTM D 2661 Appendixes.
3. PVC Piping: Join according to ASTM D 2855 and ASTM D 2665 Appendixes.

3.4 SPECIALTY PIPE FITTING INSTALLATION

A. Transition Couplings:

1. Install transition couplings at joints of piping with small differences in OD's.
2. In Drainage Piping: **Shielded**, nonpressure transition couplings.

3.5 VALVE INSTALLATION

A. Backwater Valves: Install backwater valves in piping subject to backflow.

1. Horizontal Piping: Horizontal backwater valves. **Use normally closed type unless otherwise indicated.**
2. Install backwater valves in accessible locations.
3. Comply with requirements for backwater valves specified in Section 221423 "Storm Drainage Piping Specialties."

3.6 HANGER AND SUPPORT INSTALLATION

A. Comply with requirements for seismic-restraint devices specified in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."

B. Comply with requirements for pipe hanger and support devices and installation specified in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."

1. Install **carbon-steel** pipe hangers for horizontal piping in noncorrosive environments.
2. Install **stainless-steel fiberglass** pipe hangers for horizontal piping in corrosive environments.
3. Install **carbon-steel** pipe support clamps for vertical piping in noncorrosive environments.
4. Install stainless-steel pipe support clamps for vertical piping in corrosive environments.
5. Vertical Piping: MSS Type 8 or Type 42, clamps.
6. Individual, Straight, Horizontal Piping Runs:

    a. 100 Feet (30 m) and Less: MSS Type 1, adjustable, steel clevis hangers.
    b. Longer Than 100 Feet (30 m): MSS Type 43, adjustable roller hangers.
    c. Longer Than 100 Feet (30 m) if Indicated: MSS Type 49, spring cushion rolls.

7. Multiple, Straight, Horizontal Piping Runs 100 Feet (30 m) or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
8. Base of Vertical Piping: MSS Type 52, spring hangers.

C. Support horizontal piping and tubing within 12 inches (300 mm) of each fitting**[, valve,]** and coupling.

D. Support vertical piping and tubing at base and at each floor.

E. Rod diameter may be reduced one size for double-rod hangers, with 3/8-inch (10-mm) minimum rods.

F. Install hangers for cast-iron soil piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/2 and NPS 2 (DN 40 and DN 50): 60 inches (1500 mm) with 3/8-inch (10-mm) rod.
2. NPS 3 (DN 80): 60 inches (1500 mm) with 1/2-inch (13-mm) rod.
3. NPS 4 and NPS 5 (DN 100 and DN 125): 60 inches (1500 mm) with 5/8-inch (16-mm) rod.
4. NPS 6 and NPS 8 (DN 150 and DN 200): 60 inches (1500 mm) with 3/4-inch (19-mm) rod.
5. NPS 10 and NPS 12 (DN 250 and DN 300): 60 inches (1500 mm) with 7/8-inch (22-mm) rod.
6. Spacing for 10-foot (3-m) pipe lengths may be increased to 10 feet (3 m). Spacing for fittings is limited to 60 inches (1500 mm).

G. Install supports for vertical cast-iron soil piping every 15 feet (4.5 m).

H. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/4 (DN 32): 72 inches (1800 mm) with 3/8-inch (10-mm) rod.
2. NPS 1-1/2 and NPS 2 (DN 40 and DN 50): 96 inches (2400 mm) with 3/8-inch (10-mm) rod.
3. NPS 2-1/2 (DN 65): 108 inches (2700 mm) with 1/2-inch (13-mm) rod.
4. NPS 3 to NPS 5 (DN 80 to DN 125): 10 feet (3 m) with 1/2-inch (13-mm) rod.
5. NPS 6 (DN 150): 10 feet (3 m) with 5/8-inch (16-mm) rod.
6. NPS 8 (DN 200): 10 feet (3 m) with 3/4-inch (19-mm) rod.

I. Install supports for vertical copper tubing every 10 feet (3 m).

J. Install hangers for **ABS and PVC** piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/2 and NPS 2 (DN 40 and DN 50): 48 inches (1200 mm) with 3/8-inch (10-mm) rod.
2. NPS 3 (DN 80): 48 inches (1200 mm) with 1/2-inch (13-mm) rod.
3. NPS 4 and NPS 5 (DN 100 and DN 125): 48 inches (1200 mm) with 5/8-inch (16-mm) rod.
4. NPS 6 and NPS 8 (DN 150 and DN 200): 48 inches (1200 mm) with 3/4-inch (19-mm) rod.
5. NPS 10 and NPS 12 (DN 250 and DN 300): 48 inches (1200 mm) with 7/8-inch (22-mm) rod.

K. Install supports for vertical **ABS and PVC** piping every 48 inches (1200 mm).

L. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

3.7 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect interior storm drainage piping to exterior storm drainage piping. Use transition fitting to join dissimilar piping materials.

C. Connect storm drainage piping to roof drains and storm drainage specialties.

1. Install test tees (wall cleanouts) in conductors near floor, and floor cleanouts with cover flush with floor.

D. Where installing piping adjacent to equipment, allow space for service and maintenance of equipment.

3.8 IDENTIFICATION

A. Identify exposed storm drainage piping. Comply with requirements for identification specified in Section 220553 "Identification for Plumbing Piping and Equipment."

3.9 FIELD QUALITY CONTROL

A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.

1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in.
2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.

B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.

C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

D. Test storm drainage piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:

1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.

2. Leave uncovered and unconcealed new, altered, extended, or replaced storm drainage piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
3. Test Procedure: Test storm drainage piping[**, except outside leaders,**] on completion of roughing-in. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water (30 kPa). From 15 minutes before inspection starts until completion of inspection, water level must not drop. Inspect joints for leaks.
4. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
5. Prepare reports for tests and required corrective action.

3.10 CLEANING

A. Clean interior of piping. Remove dirt and debris as work progresses.

B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.

C. Place plugs in ends of uncompleted piping at end of day and when work stops.

3.11 PIPING SCHEDULE

A. Flanges and unions may be used on aboveground pressure piping unless otherwise indicated.

B. Aboveground storm drainage piping **NPS 6 (DN 150) and smaller** shall be **any of** the following:

1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
2. Hubless, cast-iron soil pipe and fittings; **CISPI, heavy-duty,** hubless-piping couplings; and coupled joints.
3. Copper DWV tube, copper drainage fittings, and soldered joints.
4. **Solid-wall** ABS pipe, ABS socket fittings, and solvent-cemented joints.
5. **Solid-wall** PVC pipe, PVC socket fittings, and solvent-cemented joints.
6. Dissimilar Pipe-Material Couplings: **Shielded**, non-pressure transition couplings.

C. Aboveground, storm drainage piping **NPS 8 (DN 200) and larger** shall be **any of** the following:

1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
2. Hubless, cast-iron soil pipe and fittings; **CISPI, heavy-duty,** hubless-piping couplings; and coupled joints.
3. Copper DWV tube, copper drainage fittings, and soldered joints.
4. **Solid-wall** PVC pipe, PVC socket fittings, and solvent-cemented joints.
5. Dissimilar Pipe-Material Couplings: **Shielded**, non-pressure transition couplings.

D. Underground storm drainage piping **NPS 6 (DN 150) and smaller** shall be **any of** the following:

1. **Service** class, cast-iron soil pipe and fittings; **gaskets; and gasketed** joints.
2. Hubless, cast-iron soil pipe and fittings; **CISPI, heavy-duty,** hubless-piping couplings; and coupled joints.
3. **Solid-wall** ABS pipe, ABS socket fittings, and solvent-cemented joints.
4. **Solid-wall** PVC pipe, PVC socket fittings, and solvent-cemented joints.
5. Dissimilar Pipe-Material Couplings: **Shielded**, non-pressure transition couplings.

E. Underground, storm drainage piping **NPS 8 (DN 200) and larger** shall be **any of** the following:

1. **Service**]class, cast-iron soil pipe and fittings; **gaskets; and gasketed calking materials; and calked**] joints.
2. Hubless, cast-iron soil pipe and fittings; **CISPI, heavy-duty, cast-iron,** hubless-piping couplings; and coupled joints.
3. **Solid-wall** PVC pipe, PVC socket fittings, and solvent-cemented joints.
4. Cellular-core, sewer and drain series, PVC pipe; PVC socket fittings; and solvent-cemented joints.
5. Dissimilar Pipe-Material Couplings:**Shielded**, non-pressure transition couplings.

END OF SECTION 221413

SECTION 221429

SUMP PUMPS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Submersible sump pumps.
2. Wet-pit-volute sump pumps.
3. Sump-pump basins and basin covers.

1.2 ACTION SUBMITTALS

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

B. Wiring Diagrams: For power, signal, and control wiring.

1.3 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.4 QUALITY ASSURANCE

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. UL Compliance: Comply with UL 778 for motor-operated water pumps.

PART 2 - PRODUCTS

2.1 SUBMERSIBLE SUMP PUMPS

A. Submersible, Fixed-Position, Single-Seal Sump Pumps:

1. Description: Factory-assembled and -tested sump-pump unit.
2. Pump Type: Submersible, end-suction, single-stage, close-coupled, overhung-impeller, centrifugal sump pump as defined in HI 1.1-1.2 and HI 1.3.
3. Pump Casing: Cast iron, with strainer inlet, legs that elevate pump to permit flow into impeller, and vertical discharge for piping connection.

4. Impeller: Statically and dynamically balanced, **ASTM A 48/A 48M, Class No. 25 A cast iron ASTM A 532/A 532M, abrasion-resistant cast iron and ASTM B 584, cast bronze**], design for clear wastewater handling, and keyed and secured to shaft.
5. Pump and Motor Shaft: Stainless steel, with factory-sealed, grease-lubricated ball bearings.
6. Seal: Mechanical.
7. Motor: Hermetically sealed, capacitor-start type; with built-in overload protection; lifting eye or lug; and three-conductor, waterproof power cable of length required and with grounding plug and cable-sealing assembly for connection at pump.

    a. Motor Housing Fluid: **Oil**.

8. Controls:

    a. Enclosure: NEMA 250, **Type 1** .
    b. Switch Type: Pedestal-mounted float switch with float rods and rod buttons.
    c. Automatic Alternator: Start pumps on successive cycles and start multiple pumps if one cannot handle load.
    d. Float Guides: Pipe or other restraint for floats and rods in basins of depth greater than 60 inches (1500 mm).
    e. High-Water Alarm: Cover-mounted, compression-probe alarm, with electric bell; 120-V ac, with transformer and contacts for remote alarm bell.

9. Controls:

    a. Enclosure: NEMA 250, [**Type 1**] **wall**-mounted.
    b. Switch Type: [**Mechanical-float**] type, in NEMA 250, Type 6 enclosures with mounting rod and electric cables.
    c. Automatic Alternator: Start pumps on successive cycles and start multiple pumps if one cannot handle load.
    d. High-Water Alarm: Rod-mounted, NEMA 250, Type 6 enclosure with **mechanical-float,** switch matching control and electric bell; 120-V ac, with transformer and contacts for remote alarm bell.

10. Control-Interface Features:

    a. Remote Alarm Contacts: For remote alarm interface.
    b. Building Automation System Interface: Auxiliary contacts in pump controls for interface to building automation system and capable of providing the following:

        1) On-off status of pump.
        2) Alarm status.

2.2 WET-PIT-VOLUTE SUMP PUMPS

A. Description: Factory-assembled and -tested sump-pump unit.

B. Pump Type: Wet-pit-volute, single-stage, separately-coupled, overhung-impeller, centrifugal sump pump as defined in HI 1.1-1.2 and HI 1.3.

C. Pump Casing: Cast iron, with strainer inlet and threaded connection for NPS 2 (DN 50) and smaller and flanged connection for NPS 2-1/2 (DN 65) and larger discharge piping.

D. Impeller: Statically and dynamically balanced, [**ASTM A 48/A 48M, Class No. 25 A cast iron**] [**ASTM A 532/A 532M, abrasion-resistant cast iron**] [**and**] [**ASTM B 584, cast bronze**], [**semiopen**] > design for clear wastewater handling, and keyed and secured to shaft.

E. Sleeve Bearings: Bronze. Include oil-lubricated, intermediate sleeve bearings at 48-inch (1200-mm) maximum intervals if basin depth is more than 48 inches (1200 mm), and grease-lubricated, ball-type thrust bearings.

F. Pump and Motor Shaft Coupling: Flexible, capable of absorbing torsional vibration and shaft misalignment.

G. Pump Discharge Piping: Factory or field fabricated, **galvanized, ASTM A 53/A 53M, Schedule 40, steel pipe with ASME B16.1, Class 125, cast-iron flanges and flanged fittings or ASME B16.4, Class 125, gray iron threaded fittings**].

H. Support Plate: Cast iron or coated steel and strong enough to support pumps, motors, and controls. Refer to Part 2 "Sump-Pump Basins and Basin Covers" Article for requirements.

I. Shaft Seal: Stuffing box, with graphite-impregnated braided-yarn rings and bronze packing gland.

J. Motor: Single-speed; grease-lubricated ball bearings and mounting on vertical, cast-iron pedestal.

K. Controls:

1. Enclosure: NEMA 250, **Type 1**.
2. Switch Type: Pedestal-mounted float switch with float rods and rod buttons.
3. Automatic Alternator: Start pumps on successive cycles and start multiple pumps if one cannot handle load.
4. Float Guides: Pipe or other restraint for floats and rods in basins of depth greater than 60 inches (1500 mm).
5. High-Water Alarm: Cover-mounted, compression-probe alarm, with electric bell; 120-V ac, with transformer and contacts for remote alarm bell.

L. Controls:

1. Enclosure: NEMA 250, **Type 1 wall**-mounted.
2. Switch Type: **Mechanical-float** type, in NEMA 250, Type 6 enclosures with mounting rod and electric cables.
3. Automatic Alternator: Start pumps on successive cycles and start multiple pumps if one cannot handle load.

4. High-Water Alarm: Rod-mounted, NEMA 250, Type 6 enclosure with **mechanical-float,** switch matching control and electric bell; 120-V ac, with transformer and contacts for remote alarm bell.

M. Control-Interface Features:

1. Remote Alarm Contacts: For remote alarm interface.
2. Building Automation System Interface: Auxiliary contacts in pump controls for interface to building automation system and capable of providing the following:

a. On-off status of pump.
b. Alarm status.

2.3 SUMP PUMP CAPACITIES AND CHARACTERISTICS

A. Unit Capacity: 50 **gpm (L/minute)**>.

B. Number of Pumps: [**One**] .

C. Each Pump:

1. Capacity: 50 **gpm (L/minute)**>.
2. Discharge Size: 1-1/2”
3. Electrical Characteristics:
   a. Volts: [**120**.
   b. Phases: [**Single**]
   c. Hertz: 60.

2.4 SUMP-PUMP BASINS AND BASIN COVERS

A. Basins: Factory-fabricated, watertight, cylindrical, basin sump with top flange and sidewall openings for pipe connections.

1. Material: [**Fiberglass**] .
2. Reinforcement: Mounting plates for pumps, fittings, and accessories.
3. Anchor Flange: Same material as or compatible with basin sump, cast in or attached to sump, in location and of size required to anchor basin in concrete slab.

B. Basin Covers: Fabricate metal cover with openings having gaskets, seals, and bushings; for access to pumps, pump shafts, control rods, discharge piping, vent connections, and power cables.

1. Reinforcement: Steel or cast iron, capable of supporting foot traffic for basins installed in foot-traffic areas.
2. Manhole Required in Cover: [**Yes**]

2.5 MOTORS

A. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Section 220513 "Common Motor Requirements for Plumbing Equipment."

1. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.

B. Motors for submersible pumps shall be hermetically sealed.

PART 3 - EXECUTION

3.1 EARTHWORK

A. Excavation and filling are specified in Section 312000 "Earth Moving."

3.2 INSTALLATION

A. Pump Installation Standard: Comply with HI 1.4 for installation of sump pumps.

END OF SECTION 221429

SECTION 221600

FACILITY NATURAL-GAS PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Pipes, tubes, and fittings.
2. Piping specialties.
3. Piping and tubing joining materials.
4. Valves.
5. Pressure regulators.

1.2 ACTION SUBMITTALS

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

B. Shop Drawings: For facility natural-gas piping layout. Include plans, piping layout and elevations, sections, and details for fabrication of pipe anchors, hangers, supports for multiple pipes, alignment guides, expansion joints and loops, and attachments of the same to building structure. Detail location of anchors, alignment guides, and expansion joints and loops.

C. Delegated-Design Submittal: For natural-gas piping and equipment 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. Detail fabrication and assembly of seismic restraints.
2. Design Calculations: Calculate requirements for selecting seismic restraints.

1.3 INFORMATIONAL SUBMITTALS

A. Welding certificates.

B. Field quality-control reports.

1.4 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.5 QUALITY ASSURANCE

A. Steel Support Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

C. 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.

PART 2 - PRODUCTS

2.1 PIPES, TUBES, AND FITTINGS

A. Steel Pipe: ASTM A 53/A 53M, black steel, Schedule 40, Type E or S, Grade B.

1. Malleable-Iron Threaded Fittings: ASME B16.3, Class 150, standard pattern.
2. Wrought-Steel Welding Fittings: ASTM A 234/A 234M for butt welding and socket welding.
3. Unions: ASME B16.39, Class 150, malleable iron with brass-to-iron seat, ground joint, and threaded ends.
4. Protective Coating for Underground Piping: Factory-applied, three-layer coating of epoxy, adhesive, and PE.

    a. Joint Cover Kits: Epoxy paint, adhesive, and heat-shrink PE sleeves.

B. Corrugated, Stainless-Steel Tubing: Comply with ANSI/IAS LC 1.
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. OmegaFlex, Inc.
    b. Parker Hannifin Corporation; Parflex Division.
    c. Titeflex.
    d. Tru-Flex Metal Hose Corp.

2. Tubing: ASTM A 240/A 240M, corrugated, Series 300 stainless steel.
3. Coating: PE with flame retardant.

    a. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 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: 50 or less.

4. Fittings: Copper-alloy mechanical fittings with ends made to fit and listed for use with corrugated stainless-steel tubing and capable of metal-to-metal seal without gaskets. Include brazing socket or threaded ends complying with ASME B1.20.1.
5. Striker Plates: Steel, designed to protect tubing from penetrations.
6. Manifolds: Malleable iron or steel with factory-applied protective coating. Threaded connections shall comply with ASME B1.20.1 for pipe inlet and corrugated tubing outlets.
7. Operating-Pressure Rating: 5 psig (34.5 kPa).

C. PE Pipe: ASTM D 2513, SDR 11.

1. PE Fittings: ASTM D 2683, socket-fusion type or ASTM D 3261, butt-fusion type with dimensions matching PE pipe.
2. PE Transition Fittings: Factory-fabricated fittings with PE pipe complying with ASTM D 2513, SDR 11; and steel pipe complying with ASTM A 53/A 53M, black steel, Schedule 40, Type E or S, Grade B.
3. Anodeless Service-Line Risers: Factory fabricated and leak tested.

    a. Underground Portion: PE pipe complying with ASTM D 2513, SDR 11 inlet.
    b. Casing: Steel pipe complying with ASTM A 53/A 53M, Schedule 40, black steel, Type E or S, Grade B, with corrosion-protective coating covering.
    c. Aboveground Portion: PE transition fitting.
    d. Outlet shall be threaded or suitable for welded connection.
    e. Tracer wire connection.
    f. Ultraviolet shield.
    g. Stake supports with factory finish to match steel pipe casing or carrier pipe.

4. Transition Service-Line Risers: Factory fabricated and leak tested.

    a. Underground Portion: PE pipe complying with ASTM D 2513, SDR 11 inlet connected to steel pipe complying with ASTM A 53/A 53M, Schedule 40, Type E or S, Grade B, with corrosion-protective coating for aboveground outlet.
    b. Outlet shall be threaded or suitable for welded connection.
    c. Bridging sleeve over mechanical coupling.
    d. Factory-connected anode.
    e. Tracer wire connection.
    f. Ultraviolet shield.
    g. Stake supports with factory finish to match steel pipe casing or carrier pipe.

D. Pre-Sleeved and Vented, Corrugated, Stainless-Steel Tubing: Comply with ANSI/IAS LC 1.
1. Underground piping shall consist of corrugated, stainless-steel tubing sleeved with a black integral polyethylene sleeve. The external polyethylene sleeve shall be designed to withstand the superimposed loads. The external protective sleeve shall have internal vent channels lengthwise to direct any leakage along the pipe to the end fittings.
2. For gas piping under building slabs, Plumbing, Mechanical and Fuel Gas Code requirements shall be followed for encasement within a conduit and venting to the atmosphere. The construction of the pre-sleeved system shall provide the encasement and venting capabilities required by the codes.

3. Underground fittings may be used within the system. All metallic parts of the buried fittings shall be wrapped in a code-approved manner (e.g. mastic used for wrapping metallic pipe). Underground fittings are not permitted under the slab of a building.
4. The underground piping system shall be listed by either ICC or IAPMO for use in underground or underground beneath building applications.

2.2 PIPING SPECIALTIES

A. Appliance Flexible Connectors:

1. Indoor, Fixed-Appliance Flexible Connectors: Comply with ANSI Z21.24.
2. Indoor, Movable-Appliance Flexible Connectors: Comply with ANSI Z21.69.
3. Outdoor, Appliance Flexible Connectors: Comply with ANSI Z21.75.
4. Corrugated stainless-steel tubing with polymer coating.
5. Operating-Pressure Rating: 0.5 psig (3.45 kPa).
6. End Fittings: Zinc-coated steel.
7. Threaded Ends: Comply with ASME B1.20.1.
8. Maximum Length: 72 inches (1830 mm.)

B. Quick-Disconnect Devices: Comply with ANSI Z21.41.

1. Copper-alloy convenience outlet and matching plug connector.
2. Nitrile seals.
3. Hand operated with automatic shutoff when disconnected.
4. For indoor or outdoor applications.
5. Adjustable, retractable restraining cable.

C. Y-Pattern Strainers:

1. Body: ASTM A 126, Class B, cast iron with bolted cover and bottom drain connection.
2. End Connections: Threaded ends for NPS 2 (DN 50) and smaller.
3. Strainer Screen: 40-mesh startup strainer, and perforated stainless-steel basket with 50 percent free area.
4. CWP Rating: 125 psig (862 kPa).

D. Weatherproof Vent Cap: Cast- or malleable-iron increaser fitting with corrosion-resistant wire screen, with free area at least equal to cross-sectional area of connecting pipe and threaded-end connection.

2.3 JOINING MATERIALS

A. Joint Compound and Tape: Suitable for natural gas.

B. Welding Filler Metals: Comply with AWS D10.12/D10.12M for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

C. Brazing Filler Metals: Alloy with melting point greater than 1000 deg F (540 deg C) complying with AWS A5.8/A5.8M. Brazing alloys containing more than 0.05 percent phosphorus are prohibited.

2.4 MANUAL GAS SHUTOFF VALVES

A. See "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles for where each valve type is applied in various services.

B. General Requirements for Metallic Valves, NPS 2 (DN 50) and Smaller: Comply with ASME B16.33.

1. CWP Rating: 125 psig (862 kPa).
2. Threaded Ends: Comply with ASME B1.20.1.
3. Dryseal Threads on Flare Ends: Comply with ASME B1.20.3.
4. Tamperproof Feature: Locking feature for valves indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
5. Listing: Listed and labeled by an NRTL acceptable to authorities having jurisdiction for valves 1 inch (25 mm) and smaller.
6. Service Mark: Valves 1-1/4 inches (32 mm) to NPS 2 (DN 50) shall have initials "WOG" permanently marked on valve body.

C. One-Piece, Bronze Ball Valve with Bronze Trim: MSS SP-110.

1. Body: Bronze, complying with ASTM B 584.
2. Ball: Chrome-plated brass.
3. Stem: Bronze; blowout proof.
4. Seats: Reinforced TFE; blowout proof.
5. Packing: Separate packnut with adjustable-stem packing threaded ends.
6. Ends: Threaded, flared, or socket as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
7. CWP Rating: 600 psig (4140 kPa).
8. Listing: Valves NPS 1 (DN 25) and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
9. Service: Suitable for natural-gas service with "WOG" indicated on valve body.

D. Two-Piece, Full-Port, Bronze Ball Valves with Bronze Trim: MSS SP-110.

1. Body: Bronze, complying with ASTM B 584.
2. Ball: Chrome-plated bronze.
3. Stem: Bronze; blowout proof.
4. Seats: Reinforced TFE; blowout proof.
5. Packing: Threaded-body packnut design with adjustable-stem packing.
6. Ends: Threaded, flared, or socket as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
7. CWP Rating: 600 psig (4140 kPa).

8. Listing: Valves NPS 1 (DN 25) and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
9. Service: Suitable for natural-gas service with "WOG" indicated on valve body.

E. Two-Piece, Regular-Port Bronze Ball Valves with Bronze Trim: MSS SP-110.

1. Body: Bronze, complying with ASTM B 584.
2. Ball: Chrome-plated bronze.
3. Stem: Bronze; blowout proof.
4. Seats: Reinforced TFE.
5. Packing: Threaded-body packnut design with adjustable-stem packing.
6. Ends: Threaded, flared, or socket as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
7. CWP Rating: 600 psig (4140 kPa).
8. Listing: Valves NPS 1 (DN 25) and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
9. Service: Suitable for natural-gas service with "WOG" indicated on valve body.

F. Bronze Plug Valves: MSS SP-78.

1. Body: Bronze, complying with ASTM B 584.
2. Plug: Bronze.
3. Ends: Threaded, socket, as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
4. Operator: Square head or lug type with tamperproof feature where indicated.
5. Pressure Class: 125 psig (862 kPa).
6. Listing: Valves NPS 1 (DN 25) and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
7. Service: Suitable for natural-gas service with "WOG" indicated on valve body.

G. PE Ball Valves: Comply with ASME B16.40.

1. Body: PE.
2. Ball: PE.
3. Stem: Acetal.
4. Seats and Seals: Nitrile.
5. Ends: Plain or fusible to match piping.
6. CWP Rating: 80 psig (552 kPa).
7. Operating Temperature: Minus 20 to plus 140 deg F (Minus 29 to plus 60 deg C) Operator: Nut or flat head for key operation.
8. Include plastic valve extension.
9. Include tamperproof locking feature for valves where indicated on Drawings.

H. Valve Boxes:

1. Cast-iron, two-section box.
2. Top section with cover with "GAS" lettering.
3. Bottom section with base to fit over valve and barrel a minimum of 5 inches (125 mm) in diameter.
4. Adjustable cast-iron extensions of length required for depth of bury.

5. Include tee-handle, steel operating wrench with socket end fitting valve nut or flat head, and with stem of length required to operate valve.

2.5 PRESSURE REGULATORS

A. General Requirements:

1. Single stage and suitable for natural gas.
2. Steel jacket and corrosion-resistant components.
3. Elevation compensator.
4. End Connections: Threaded for regulators NPS 2 (DN 50) and smaller.

B. Line Pressure Regulators: Comply with ANSI Z21.80.
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. Actaris.
   b. American Meter Company.
   c. Eclipse Combustion, Inc.
   d. Fisher Control Valves and Regulators; Division of Emerson Process Management.
   e. Invensys.
   f. Maxitrol Company.
   g. Richards Industries; Jordan Valve Div.

2. Body and Diaphragm Case: Cast iron or die-cast aluminum.
3. Springs: Zinc-plated steel; interchangeable.
4. Diaphragm Plate: Zinc-plated steel.
5. Seat Disc: Nitrile rubber resistant to gas impurities, abrasion, and deformation at the valve port.
6. Orifice: Aluminum; interchangeable.
7. Seal Plug: Ultraviolet-stabilized, mineral-filled nylon.
8. Single-port, self-contained regulator with orifice no larger than required at maximum pressure inlet, and no pressure sensing piping external to the regulator.
9. Pressure regulator shall maintain discharge pressure setting downstream, and not exceed 150 percent of design discharge pressure at shutoff.
10. Overpressure Protection Device: Factory mounted on pressure regulator.
11. Atmospheric Vent: Factory- or field-installed, stainless-steel screen in opening if not connected to vent piping.

C. Appliance Pressure Regulators: Comply with ANSI Z21.18.
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. Canadian Meter Company Inc.
   b. Eaton Corporation; Controls Div.
   c. Harper Wyman Co.
   d. Maxitrol Company.
   e. SCP, Inc.

2. Body and Diaphragm Case: Die-cast aluminum.
3. Springs: Zinc-plated steel; interchangeable.
4. Diaphragm Plate: Zinc-plated steel.
5. Seat Disc: Nitrile rubber.
6. Seal Plug: Ultraviolet-stabilized, mineral-filled nylon.
7. Factory-Applied Finish: Minimum three-layer polyester and polyurethane paint finish.
8. Regulator may include vent limiting device, instead of vent connection, if approved by authorities having jurisdiction.

2.6 DIELECTRIC UNIONS

A. Dielectric Unions:

1. Description:

a. Standard: ASSE 1079.
b. Pressure Rating: 125 psig (860 kPa) minimum at 180 deg F (82 deg C).
c. End Connections: Solder-joint copper alloy and threaded ferrous.

PART 3 - EXECUTION

3.1 OUTDOOR PIPING INSTALLATION

A. Install underground, natural-gas piping buried at least 36 inches (900 mm) below finished grade. Comply with requirements in Section 312000 "Earth Moving" for excavating, trenching, and backfilling.

1. If natural-gas piping is installed less than 36 inches (900 mm) below finished grade, install it in containment conduit.

B. Install underground, PE, natural-gas piping according to ASTM D 2774.

C. Steel Piping with Protective Coating:

1. Apply joint cover kits to pipe after joining to cover, seal, and protect joints.
2. Repair damage to PE coating on pipe as recommended in writing by protective coating manufacturer.
3. Replace pipe having damaged PE coating with new pipe.

D. Copper Tubing with Protective Coating:

1. Apply joint cover kits over tubing to cover, seal, and protect joints.
2. Repair damage to PE coating on pipe as recommended in writing by protective coating manufacturer.

E. Install fittings for changes in direction and branch connections.

3.2 INDOOR PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

B. Arrange for pipe spaces, chases, slots, sleeves, and openings in building structure during progress of construction, to allow for mechanical installations.

C. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

F. Locate valves for easy access.

G. Install natural-gas piping at uniform grade of 2 percent down toward drip and sediment traps.

H. Install piping free of sags and bends.

I. Install fittings for changes in direction and branch connections.

J. Verify final equipment locations for roughing-in.

K. Comply with requirements in Sections specifying gas-fired appliances and equipment for roughing-in requirements.

L. Drips and Sediment Traps: Install drips at points where condensate may collect, including service-meter outlets. Locate where accessible to permit cleaning and emptying. Do not install where condensate is subject to freezing.

1. Construct drips and sediment traps using tee fitting with bottom outlet plugged or capped. Use nipple a minimum length of 3 pipe diameters, but not less than 3 inches (75 mm) long and same size as connected pipe. Install with space below bottom of drip to remove plug or cap.

M. Extend relief vent connections for service regulators, line regulators, and overpressure protection devices to outdoors and terminate with weatherproof vent cap.

N. Conceal pipe installations in walls, pipe spaces, utility spaces, above ceilings, below grade or floors, and in floor channels unless indicated to be exposed to view.

O. Use eccentric reducer fittings to make reductions in pipe sizes. Install fittings with level side down.

P. Connect branch piping from top or side of horizontal piping.

Q. Install unions in pipes NPS 2 (DN 50) and smaller, adjacent to each valve, at final connection to each piece of equipment.

R. Do not use natural-gas piping as grounding electrode.

S. Install strainer on inlet of each line-pressure regulator and automatic or electrically operated valve.

T. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 230517 "Sleeves and Sleeve Seals for HVAC Piping."

U. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 230517 "Sleeves and Sleeve Seals for HVAC Piping."

V. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 230518 "Escutcheons for HVAC Piping."

3.3 VALVE INSTALLATION

A. Install manual gas shutoff valve for each gas appliance ahead of corrugated stainless-steel tubing or copper connector.

B. Install underground valves with valve boxes.

C. Install regulators and overpressure protection devices with maintenance access space adequate for servicing and testing.

D. Install anode for metallic valves in underground PE piping.

3.4 PIPING JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs.

B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

C. Threaded Joints:

1. Thread pipe with tapered pipe threads complying with ASME B1.20.1.
2. Cut threads full and clean using sharp dies.
3. Ream threaded pipe ends to remove burrs and restore full inside diameter of pipe.
4. Apply appropriate tape or thread compound to external pipe threads unless dryseal threading is specified.

5. 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. Welded Joints:

1. Construct joints according to AWS D10.12/D10.12M, using qualified processes and welding operators.
2. Bevel plain ends of steel pipe.
3. Patch factory-applied protective coating as recommended by manufacturer at field welds and where damage to coating occurs during construction.

E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter.

F. Flared Joints: Cut tubing with roll cutting tool. Flare tube end with tool to result in flare dimensions complying with SAE J513. Tighten finger tight, then use wrench. Do not overtighten.

G. PE Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D 2657.

1. Plain-End Pipe and Fittings: Use butt fusion.
2. Plain-End Pipe and Socket Fittings: Use socket fusion.

3.5 HANGER AND SUPPORT INSTALLATION

A. Install seismic restraints on piping. Comply with requirements for seismic-restraint devices specified in Section 230548 "Vibration and Seismic Controls for HVAC."

B. Comply with requirements for pipe hangers and supports specified in Section 230529 "Hangers and Supports for HVAC Piping and Equipment."

C. Install hangers for horizontal steel piping with the following maximum spacing and minimum rod sizes:

1. NPS 1 (DN 25) and Smaller: Maximum span, 96 inches (2438 mm); minimum rod size, 3/8 inch (10 mm).
2. NPS 1-1/4 (DN 32): Maximum span, 108 inches (2743 mm); minimum rod size, 3/8 inch (10 mm).
3. NPS 1-1/2 and NPS 2 (DN 40 and DN 50): Maximum span, 108 inches (2743 mm); minimum rod size, 3/8 inch (10 mm).

D. Install hangers for horizontal, corrugated stainless-steel tubing with the following maximum spacing and minimum rod sizes:

1. NPS 3/8 (DN 10): Maximum span, 48 inches (1220 mm); minimum rod size, 3/8 inch (10 mm).
2. NPS 1/2 (DN 15): Maximum span, 72 inches (1830 mm); minimum rod size, 3/8 inch (10 mm).

3. NPS 3/4 (DN 20) and Larger: Maximum span, 96 inches (2440 mm); minimum rod size, 3/8 inch (10 mm).

3.6 CONNECTIONS

A. Connect to utility's gas main according to utility's procedures and requirements.

B. Install natural-gas piping electrically continuous, and bonded to gas appliance equipment grounding conductor of the circuit powering the appliance according to NFPA 70.

C. Install piping adjacent to appliances to allow service and maintenance of appliances.

D. Connect piping to appliances using manual gas shutoff valves and unions. Install valve within 72 inches (1800 mm) of each gas-fired appliance and equipment. Install union between valve and appliances or equipment.

E. Sediment Traps: Install tee fitting with capped nipple in bottom to form drip, as close as practical to inlet of each appliance.

3.7 PAINTING

A. Comply with requirements in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting" for painting interior and exterior natural-gas piping.

B. Paint exposed, exterior metal piping, valves, service regulators, service meters and meter bars, earthquake valves, and piping specialties, except components, with factory-applied paint or protective coating.
   1. Alkyd System: MPI EXT 5.1D.
      a. Prime Coat: Alkyd anticorrosive metal primer.
      b. Intermediate Coat: Exterior alkyd enamel matching topcoat.
      c. Topcoat: Exterior alkyd enamel flat.
      d. Color: To match surroundings and shall be approved by architect.

3.8 FIELD QUALITY CONTROL

A. Natural-gas piping will be considered defective if it does not pass tests and inspections.

B. Prepare test and inspection reports.

3.9 OUTDOOR SERVICE PIPING SCHEDULE (PIPING UPSTREAM OF METER)

A. Underground outdoor natural-gas service piping shall be:
   1. Polyethylene pipe and fittings joined by heat fusion, or mechanical couplings if allowed by the utility provider; service-line risers with tracer wire terminated in an accessible location. Polyethylene piping shall meet the requirements of ASTM D2513.

2. Contractor shall be responsible for excavation and backfill of the gas service trench, including sand below the piping and sand required for backfilling the trench.
3. Provide caution tape on top of service piping and tracer wire as required.

B. Aboveground outdoor natural-gas service piping shall be:
1. For piping 2” and smaller: Steel pipe with malleable-iron fittings and threaded joints.
2. For piping larger than 2”: Steel pipe with wrought-steel fittings and welded joints.

3.10 INDOOR HOUSE PIPING SCHEDULE (INTERIOR PIPING DOWNSTREAM OF METER)

A. Aboveground indoor house piping shall be:
1. For piping 2” and smaller: Steel pipe with malleable-iron fittings and threaded joints.
2. For piping larger than 2”: Steel pipe with wrought-steel fittings and welded joints.
3. Corrugated, Stainless-Steel Tubing

B. Underground, below building slab piping shall be:
1. Steel pipe with wrought-steel fittings, welded joints, and vented containment conduit.
2. Containment Conduit: Steel pipe with wrought-steel fittings and welded joints. Coat pipe and fittings with protective coating for steel piping.
3. Containment Conduit Vent Piping: Steel pipe with malleable-iron fittings and threaded or wrought-steel fittings with welded joints. Coat underground pipe and fittings with protective coating for steel piping. Vent to atmosphere or room at both ends.
4. Pre-Sleeved and Vented, Corrugated, Stainless-Steel Tubing

3.11 OUTDOOR HOUSE PIPING SCHEDULE (EXTERIOR PIPING DOWNSTREAM OF METER)

A. Aboveground outdoor natural-gas piping shall be:
1. For piping 2” and smaller: Steel pipe with malleable-iron fittings and threaded joints.
2. For piping larger than 2”: Steel pipe with wrought-steel fittings and welded joints.

B. Underground outdoor natural-gas piping shall be:
1. Polyethylene pipe and fittings joined by heat fusion, or mechanical couplings if allowed by the utility provider; service-line risers with tracer wire terminated in an accessible location. Polyethylene piping shall meet the requirements of ASTM D2513.
2. Steel pipe with wrought-steel fittings and welded joints, or mechanical couplings is allowed by the utility provider. Coat pipe and fittings with protective coating for steel piping.

3.12 UNDERGROUND MANUAL GAS SHUTOFF VALVE SCHEDULE

A. Connections to Existing Gas Piping: Use valve and fitting assemblies made for tapping utility's gas mains and listed by an NRTL.

B. Underground:
   1. PE valves.
   2. NPS 2 and Smaller: Bronze plug valves.
   3. NPS 2-1/2 and Larger: Cast-iron plug valves.

3.13 ABOVEGROUND MANUAL GAS SHUTOFF VALVE SCHEDULE

A. Valves for pipe sizes NPS 2 and smaller at service meter shall be one of the following:
   1. One-piece, bronze ball valve with bronze trim.
   2. Two-piece, full-port, bronze ball valves with bronze trim.
   3. Bronze plug valve.

B. Valves for pipe sizes NPS 2-1/2 and larger at service meter shall be one of the following:
   1. Two-piece, full-port, bronze ball valves with bronze trim.
   2. Bronze plug valve.
   3. Cast-iron, nonlubricated plug valve.

C. Distribution piping valves for pipe sizes NPS 2 and smaller shall be one of the following:
   1. One-piece, bronze ball valve with bronze trim.
   2. Two-piece, full-port, bronze ball valves with bronze trim.
   3. Bronze plug valve.

D. Distribution piping valves for pipe sizes NPS 2-1/2 and larger shall be one of the following:
   1. Two-piece, full-port, bronze ball valves with bronze trim.
   2. Bronze plug valve.
   3. Cast-iron, plug valve.

E. Valves in branch piping for single appliance shall be one of the following:
   1. One-piece, bronze ball valve with bronze trim.
   2. Two-piece, full-port, bronze ball valves with bronze trim.
   3. Bronze plug valve.

END OF SECTION 231123

SECTION 223400

FUEL-FIRED, DOMESTIC-WATER HEATERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Commercial, atmospheric, gas-fired, storage, domestic-water heaters.
2. Domestic-water heater accessories.

1.2 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Commercial domestic-water heaters shall withstand the effects of earthquake motions determined according to **ASCE/SEI 7**.

1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified **and the unit will be fully operational after the seismic event**."

1.3 ACTION SUBMITTALS

A. Product Data: For each type and size of domestic-water heater indicated.

B. LEED Submittals:

1. Product Data for Prerequisite EA 2: Documentation indicating that units comply with applicable requirements in ASHRAE/IESNA 90.1, Section 7, "Service Water Heating."

C. Shop Drawings:

1. Wiring Diagrams: For power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

A. Seismic Qualification Certificates: For fuel-fired, domestic-water heaters, accessories, and components, from manufacturer.

B. Product certificates.

C. Domestic-Water Heater Labeling: Certified and labeled by testing agency acceptable to authorities having jurisdiction.

D. Source quality-control reports.

E. Field quality-control reports.

F. Warranty: Sample of special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.6 QUALITY ASSURANCE

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. ASHRAE/IESNA Compliance: Fabricate and label fuel-fired, domestic-water heaters to comply with ASHRAE/IESNA 90.1.

C. ASME Compliance:

1. Where ASME-code construction is indicated, fabricate and label commercial, domestic-water heater storage tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
2. Where ASME-code construction is indicated, fabricate and label commercial, finned-tube, domestic-water heaters to comply with ASME Boiler and Pressure Vessel Code: Section IV.

D. NSF Compliance: Fabricate and label equipment components that will be in contact with potable water to comply with NSF 61, "Drinking Water System Components - Health Effects."

1.7 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of fuel-fired, domestic-water heaters that fail in materials or workmanship within specified warranty period.

1. Warranty Periods: From date of Substantial Completion.

a. Commercial, Gas-Fired, Storage, Domestic-Water Heaters:

1) Storage Tank: **Three** years.
2) Controls and Other Components: **Two** year(s).

PART 2 - PRODUCTS

2.1 COMMERCIAL, GAS-FIRED, STORAGE, DOMESTIC-WATER HEATERS

A. Commercial, Atmospheric, Gas-Fired, Storage, Domestic-Water Heaters:

1. Standard: ANSI Z21.10.3/CSA 4.3.
2. Storage-Tank Construction: [**Non-**]ASME-code steel with [**150-psig (1035-kPa)**] working-pressure rating.

    a. Tappings: Factory fabricated of materials compatible with tank. Attach tappings to tank before testing.

        1) NPS 2 (DN 50) and Smaller: Threaded ends according to ASME B1.20.1.
        2) NPS 2-1/2 (DN 65) and Larger: Flanged ends according to ASME B16.5 for steel and stainless-steel flanges, and according to ASME B16.24 for copper and copper-alloy flanges.

    b. Interior Finish: Comply with NSF 61 barrier materials for potable-water tank linings, including extending finish into and through tank fittings and outlets.
    c. Lining: **Glass** complying with NSF 61 barrier materials for potable-water tank linings, including extending lining into and through tank fittings and outlets.

3. Factory-Installed Storage-Tank Appurtenances:

    a. Anode Rod: Replaceable magnesium.
    b. Dip Tube: Required unless cold-water inlet is near bottom of tank.
    c. Drain Valve: Corrosion-resistant metal complying with ASSE 1005.
    d. Insulation: Comply with ASHRAE/IESNA 90.1. Surround entire storage tank except connections and controls.
    e. Jacket: Steel with enameled finish.
    f. Burner: For use with atmospheric, gas-fired, domestic-water heaters and **natural-gas** fuel.
    g. Automatic Ignition: ANSI Z21.20/CSA C22.2 No. 199, electric, automatic, gas-ignition system.
    h. Temperature Control: Adjustable thermostat.
    i. Safety Controls: Automatic, high-temperature-limit and low-water cutoff devices or systems.
    j. Combination Temperature-and-Pressure Relief Valves: ANSI Z21.22/CSA 4.4-M. Include one or more relief valves with total relieving capacity at least as great as heat input, and include pressure setting less than domestic-water heater working-pressure rating. Select one relief valve with sensing element that extends into storage tank.

4. Special Requirements: NSF 5 construction.
5. Draft Hood: Draft diverter, complying with ANSI Z21.12.

B. Commercial, Power-Burner, Gas-Fired, Storage, Domestic-Water Heaters:

1. Standard: ANSI Z21.10.3/CSA 4.3.
2. Storage-Tank Construction: [**Non-**]ASME-code steel with [**150-psig (1035-kPa)**] working-pressure rating.

    a. Tappings: Factory fabricated of materials compatible with tank. Attach tappings to tank before testing.

        1) NPS 2 (DN 50) and Smaller: Threaded ends according to ASME B1.20.1.
        2) NPS 2-1/2 (DN 65) and Larger: Flanged ends according to ASME B16.5 for steel and stainless-steel flanges and according to ASME B16.24 for copper and copper-alloy flanges.

    b. Interior Finish: Comply with NSF 61 barrier materials for potable-water tank linings, including extending finish into and through tank fittings and outlets.
    c. Lining: **Glass** complying with NSF 61 barrier materials for potable-water tank linings, including extending lining into and through tank fittings and outlets.

3. Factory-Installed Storage-Tank Appurtenances:

    a. Anode Rod: Replaceable magnesium.
    b. Dip Tube: Required unless cold-water inlet is near bottom of tank.
    c. Drain Valve: Corrosion-resistant metal complying with ASSE 1005.
    d. Insulation: Comply with ASHRAE/IESNA 90.1. Surround entire storage tank except connections and controls.
    e. Jacket: Steel with enameled finish.
    f. Burner: UL 795 for power-burner, gas-fired, domestic-water heaters and **natural-gas** > fuel.
    g. Automatic Ignition: ANSI Z21.20/CSA C22.2 No. 199, electric, automatic, gas-ignition system.
    h. Temperature Control: Adjustable thermostat.
    i. Safety Controls: Automatic, high-temperature-limit and low-water cutoff devices or systems.
    j. Combination Temperature-and-Pressure Relief Valves: ANSI Z21.22/CSA 4.4-M. Include one or more relief valves with total relieving capacity at least as great as heat input, and include pressure setting less than domestic-water heater working-pressure rating. Select one relief valve with sensing element that extends into storage tank.

4. Special Requirements: NSF 5 construction.

2.2 DOMESTIC-WATER HEATER ACCESSORIES

A. Domestic-Water Compression Tanks:

1. Description: Steel, pressure-rated tank constructed with welded joints and factory-installed butyl-rubber diaphragm. Include air precharge to minimum system-operating pressure at tank.
2. Construction:

a. Tappings: Factory-fabricated steel, welded to tank before testing and labeling. Include ASME B1.20.1 pipe thread.
b. Interior Finish: Comply with NSF 61 barrier materials for potable-water tank linings, including extending finish into and through tank fittings and outlets.
c. Air-Charging Valve: Factory installed.

3. Capacity and Characteristics:

a. Working-Pressure Rating: **150 psig (1035 kPa**.
b. Capacity Acceptable: **10 gal. (37.9 L)** minimum.

B. Drain Pans: Corrosion-resistant metal with raised edge. Comply with ANSI/CSA LC 3. Include dimensions not less than base of domestic-water heater, and include drain outlet not less than NPS 3/4 (DN 20) with ASME B1.20.1 pipe threads or with ASME B1.20.7 garden-hose threads.

C. Piping-Type Heat Traps: Field-fabricated piping arrangement according to ASHRAE/IESNA 90.1[**or ASHRAE 90.2**].

D. Heat-Trap Fittings: ASHRAE 90.2.

E. Gas Shutoff Valves: ANSI Z21.15/CSA 9.1-M, manually operated. Furnish for installation in piping.

F. Gas Pressure Regulators: ANSI Z21.18/CSA 6.3, appliance type. Include [**1/2-psig (3.5-kPa)**] pressure rating as required to match gas supply.

G. Automatic Gas Valves: ANSI Z21.21/CSA 6.5, appliance, electrically operated, on-off automatic valve.

H. Combination Temperature-and-Pressure Relief Valves: Include relieving capacity at least as great as heat input, and include pressure setting less than domestic-water heater working-pressure rating. Select relief valves with sensing element that extends into storage tank.

1. Gas-Fired, Domestic-Water Heaters: ANSI Z21.22/CSA 4.4-M.

I. Pressure Relief Valves: Include pressure setting less than domestic-water heater working-pressure rating.

1. Gas-Fired, Domestic-Water Heaters: ANSI Z21.22/CSA 4.4-M.

J. Vacuum Relief Valves: ANSI Z21.22/CSA 4.4-M.

K. Domestic-Water Heater Stands: Manufacturer's factory-fabricated steel stand for floor mounting, capable of supporting domestic-water heater and water. Provide dimension that will support bottom of domestic-water heater a minimum of 18 inches (457 mm) above the floor.

L. Domestic-Water Heater Mounting Brackets: Manufacturer's factory-fabricated steel bracket for wall mounting, capable of supporting domestic-water heater and water.

2.3 SOURCE QUALITY CONTROL

A. Factory Tests: Test and inspect assembled domestic-water heaters[**and storage tanks**] specified to be ASME-code construction, according to ASME Boiler and Pressure Vessel Code.

B. Hydrostatically test[**commercial**] domestic-water heaters[**and storage tanks**] to minimum of one and one-half times pressure rating before shipment.

C. Domestic-water heaters will be considered defective if they do not pass tests and inspections. Comply with requirements in Section 014000 "Quality Requirements" for retesting and reinspecting requirements and Section 017300 "Execution" for requirements for correcting the Work.

D. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 DOMESTIC-WATER HEATER INSTALLATION

A. Commercial, Domestic-Water Heater Mounting: Install commercial domestic-water heaters on concrete base. Comply with requirements for concrete base specified in [**Section 033000 "Cast-in-Place Concrete."**] [**Section 033053 "Miscellaneous Cast-in-Place Concrete."**]

1. Exception: Omit concrete bases for commercial domestic-water heaters if installation on stand, bracket, suspended platform, or directly on floor is indicated.
2. Maintain manufacturer's recommended clearances.
3. Arrange units so controls and devices that require servicing are accessible.
4. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around the full perimeter of concrete base.
5. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
6. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
7. Install anchor bolts to elevations required for proper attachment to supported equipment.
8. Anchor domestic-water heaters to substrate.

B. Residential, Domestic-Water Heater Mounting: Install residential domestic-water heaters on [**floor**]

1. Maintain manufacturer's recommended clearances.
2. Arrange units so controls and devices that require servicing are accessible.
3. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

4. Install anchor bolts to elevations required for proper attachment to supported equipment.
5. Anchor domestic-water heaters to substrate.

C. Install domestic-water heaters level and plumb, according to layout drawings, original design, and referenced standards. Maintain manufacturer's recommended clearances. Arrange units so controls and devices needing service are accessible.

1. Install shutoff valves on domestic-water-supply piping to domestic-water heaters and on domestic-hot-water outlet piping. Comply with requirements for shutoff valves specified in Section 220523.12 "Ball Valves for Plumbing Piping," Section 220523.13 "Butterfly Valves for Plumbing Piping," and Section 220523.15 "Gate Valves for Plumbing Piping."

D. Install gas-fired, domestic-water heaters according to NFPA 54.

1. Install gas shutoff valves on gas supply piping to gas-fired, domestic-water heaters without shutoff valves.
2. Install gas pressure regulators on gas supplies to gas-fired, domestic-water heaters without gas pressure regulators if gas pressure regulators are required to reduce gas pressure at burner.
3. Install automatic gas valves on gas supplies to gas-fired, domestic-water heaters if required for operation of safety control.
4. Comply with requirements for gas shutoff valves, gas pressure regulators, and automatic gas valves specified in [**Section 231123 "Facility Natural-Gas Piping."**] [**Section 231126 "Facility Liquefied-Petroleum Gas Piping."**]

E. Install oil-fired, domestic-water heaters according to NFPA 31.

1. Install shutoff valves on fuel-oil supply piping to oil-fired water-heater burners without shutoff valves. Comply with requirements for shutoff valves specified in Section 231113 "Facility Fuel-Oil Piping."

F. Install commercial domestic-water heaters with seismic-restraint devices. Comply with requirements for seismic-restraint devices specified in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."

G. Install combination temperature-and-pressure relief valves in top portion of storage tanks. Use relief valves with sensing elements that extend into tanks. Extend commercial-water-heater relief-valve outlet, with drain piping same as domestic-water piping in continuous downward pitch, and discharge by positive air gap onto closest floor drain.

H. Install [**combination temperature-and-**]pressure relief valves in water piping for domestic-water heaters without storage. Extend commercial-water-heater relief-valve outlet, with drain piping same as domestic-water piping in continuous downward pitch, and discharge by positive air gap onto closest floor drain.

I. Install water-heater drain piping as indirect waste to spill by positive air gap into open drains or over floor drains. Install hose-end drain valves at low points in water piping for domestic-water heaters that do not have tank drains. Comply with requirements for

hose-end drain valves specified in Section 221119 "Domestic Water Piping Specialties."

J. Install thermometer on outlet piping of domestic-water heaters. Comply with requirements for thermometers specified in Section 220519 "Meters and Gages for Plumbing Piping."

K. Install piping-type heat traps on inlet and outlet piping of domestic-water heater storage tanks without integral or fitting-type heat traps.

L. Fill domestic-water heaters with water.

M. Charge domestic-water compression tanks with air.

3.2 CONNECTIONS

A. Comply with requirements for domestic-water piping specified in Section 221116 "Domestic Water Piping."

B. Comply with requirements for fuel-oil piping specified in Section 231113 "Facility Fuel-Oil Piping."

C. Comply with requirements for gas piping specified in [**Section 231123 "Facility Natural-Gas Piping."**] [**Section 231126 "Facility Liquefied-Petroleum Gas Piping."**]

D. Drawings indicate general arrangement of piping, fittings, and specialties.

E. Where installing piping adjacent to fuel-fired, domestic-water heaters, allow space for service and maintenance of water heaters. Arrange piping for easy removal of domestic-water heaters.

3.3 IDENTIFICATION

A. Identify system components. Comply with requirements for identification specified in Section 220553 "Identification for Plumbing Piping and Equipment."

3.4 FIELD QUALITY CONTROL

A. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
2. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
3. Operational Test: After electrical circuitry has been energized, start units to confirm proper operation.

4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

B. Domestic-water heaters will be considered defective if they do not pass tests and inspections. Comply with requirements in Section 014000 "Quality Requirements" for retesting and reinspecting requirements and Section 017300 "Execution" for requirements for correcting the Work.

C. Prepare test and inspection reports.

3.5 DEMONSTRATION

A. [**Engage a factory-authorized service representative to train**] [**Train**] Owner's maintenance personnel to adjust, operate, and maintain [**commercial, gas-fired, storage,**] [**commercial, oil-fired,**] domestic-water heaters.

END OF SECTION 223400

SECTION 224216.13

COMMERCIAL LAVATORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Lavatories.
2. Faucets.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. LEED Submittals:

1. Product Data for Prerequisite WE 1[**and Credit WE 3**] [**, Credit WE 2, and Credit WE 3**]: Documentation indicating flow and water consumption requirements.
2. Product Data for Prerequisite WE 1: Documentation indicating flow and water consumption requirements.

C. Shop Drawings: Include diagrams for power, signal, and control wiring of automatic faucets.

1.3 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Counter cutout templates for mounting of counter-mounted lavatories.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For lavatories and faucets to include in operation and maintenance manuals.

1. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:

a. Servicing and adjustments of automatic faucets.

PART 2 - PRODUCTS

2.1 VITREOUS-CHINA, WALL-MOUNTED LAVATORIES

A. Lavatory Vitreous china, wall mounted, with back.

1. Fixture:

   a. Standard: ASME A112.19.2/CSA B45.1.
   b. Type: For wall hanging.
   c. Nominal Size: Oval, **22 by 14 inches (559 by 356 mm**.
   d. Faucet-Hole Punching: **Three holes, 2-inch (51-mm) centers**.
   e. Faucet-Hole Location: Top.
   f. Color: **White**.
   g. Mounting Material: Chair carrier.

2. Faucet: **Solid-Brass, Manually Operated Faucets"**.
3. Support: ASME A112.6.1M, **Type II, concealed-arm lavatory carrier with escutcheons**. **Include rectangular, steel uprights.**

2.2 SOLID-BRASS, MANUALLY OPERATED FAUCETS

A. NSF Standard: Comply with NSF/ANSI 61, "Drinking Water System Components - Health Effects," for faucet materials that will be in contact with potable water.

B. Lavatory Faucets : Manual-type, **single-control mixing**, solid-brass valve.

1. Standard: ASME A112.18.1/CSA B125.1.
2. General: Include hot- and cold-water indicators; coordinate faucet inlets with supplies and fixture hole punchings; coordinate outlet with spout and fixture receptor.
3. Body Material: Commercial, solid brass.
4. Finish: **Polished chrome plate**.
5. Maximum Flow Rate: **0.5 gpm (1.5 L/min.)**.
6. Maximum Flow: **0.25 gal. (0.95 L)** per metering cycle.
7. Mounting Type: **Deck, exposed**.
8. Valve Handle(s): **Single lever**.
9. Spout: **Rigid** type.
10. Spout Outlet: **Aerator**.
11. Operation: **Compression, manual**.

2.3 SUPPLY FITTINGS

A. NSF Standard: Comply with NSF/ANSI 61, "Drinking Water System Components - Health Effects," for supply-fitting materials that will be in contact with potable water.

B. Standard: ASME A112.18.1/CSA B125.1.

C. Supply Piping: Chrome-plated-brass pipe or chrome-plated copper tube matching water-supply piping size. Include chrome-plated-brass or stainless-steel wall flange.

D. Supply Stops: Chrome-plated-brass, one-quarter-turn, ball-type or compression valve with inlet connection matching supply piping.

E. Operation: **Loose key**.

F. Risers:

1. **NPS 3/8 (DN 10)**.
2. **ASME A112.18.6, braided- or corrugated-stainless-steel, flexible hose** riser.

2.4 WASTE FITTINGS

A. Standard: ASME A112.18.2/CSA B125.2.

B. Drain: Grid type with NPS 1-1/4 (DN 32) offset and straight tailpiece.

C. Trap:

1. Size: **NPS 1-1/2 by NPS 1-1/4 (DN 40 by DN 32) NPS 1-1/4 (DN 32)**.
2. Material: Chrome-plated, **two-piece, cast-brass trap and swivel elbow with 0.032-inch- (0.83-mm-) thick brass tube to wall**] [**two-piece, cast-brass trap and ground-joint swivel elbow with 0.032-inch- (0.83-mm-) thick brass tube to wall**] [**one-piece, cast-brass trap with swivel 0.029-inch- (73-mm-) thick tubular brass wall bend**] ; and chrome-plated, brass or steel wall flange.
3. Material: Stainless-steel, two-piece trap and swivel elbow with 0.012-inch- (0.30-mm-) thick stainless-steel tube to wall; and stainless-steel wall flange.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before lavatory installation.

B. Examine counters and walls for suitable conditions where lavatories will be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install lavatories level and plumb according to roughing-in drawings.

B. Install supports, affixed to building substrate, for wall-mounted lavatories.

C. Install accessible wall-mounted lavatories at handicapped/elderly mounting height for people with disabilities or the elderly, according to ICC/ANSI A117.1.

D. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep-pattern escutcheons if required to conceal protruding fittings. Comply with escutcheon requirements specified in Section 220518 "Escutcheons for Plumbing Piping."

E. Seal joints between lavatories and counters and walls using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Comply with sealant requirements specified in Section 079200 "Joint Sealants."

F. Install protective shielding pipe covers and enclosures on exposed supplies and waste piping of accessible lavatories. Comply with requirements in Section 220719 "Plumbing Piping Insulation."

3.3 CONNECTIONS

A. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.

B. Comply with water piping requirements specified in Section 221116 "Domestic Water Piping."

C. Comply with soil and waste piping requirements specified in Section 221316 "Sanitary Waste and Vent Piping."

3.4 ADJUSTING

A. Operate and adjust lavatories and controls. Replace damaged and malfunctioning lavatories, fittings, and controls.

B. Adjust water pressure at faucets to produce proper flow.

C. Install fresh batteries in battery-powered, electronic-sensor mechanisms.

3.5 CLEANING AND PROTECTION

A. After completing installation of lavatories, inspect and repair damaged finishes.

B. Clean lavatories, faucets, and other fittings with manufacturers' recommended cleaning methods and materials.

C. Provide protective covering for installed lavatories and fittings.

D. Do not allow use of lavatories for temporary facilities unless approved in writing by Owner.

END OF SECTION 224216.13

SECTION 224713

DRINKING FOUNTAINS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes drinking fountains and related components.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of drinking fountains.

B. LEED Submittals:

1. Product Data for Prerequisite WE 1[**and Credit WE 3**] [**, Credit WE 2, and Credit WE 3**]: Documentation indicating flow and water consumption requirements.

1.3 CLOSEOUT SUBMITTALS

A. Maintenance Data: For drinking fountains to include in maintenance manuals.

PART 2 - PRODUCTS

2.1 DRINKING FOUNTAINS

A. Drinking Fountains **wheelchair accessible**.

1. Concrete Drinking Fountains:

2. Cast-Iron or Steel Drinking Fountains:

3. Standards: Comply with ICC A117.1 and NSF 61.
4. Pedestal: [**Rectangular**] , [**with offset to receptor**
5. Receptor(s):

a. Number: [**Two**.
b. Material: **Chrome-plated brass or stainless steel** >.
c. Shape: [**Rectangular**.
d. Bubbler: One for each receptor, with adjustable stream regulator.
e. Drain: Grid type with NPS 1-1/4 (DN 32) tailpiece.

6. Controls: **Push button**
7. Access to Internal Components: Panel in pedestal.
8. Supply Piping: [**NPS 3/8 (DN 10)**] [**NPS 1/2 (DN 15)**] with shutoff valve.
9. Drain Piping: [**NPS 1-1/4 (DN 32)**] [**NPS 1-1/2 (DN 40)**] minimum trap and waste.

B. Drinking Fountains **Stainless steel**, wall mounted.

1. Stainless-Steel Drinking Fountains:

2. Standards:

   a. Comply with ASME A112.19.3/CSA B45.4.
   b. Comply with NSF 61.

3. Type Receptor: **Slab With back On horizontal support**.
4. Receptor Shape: **Rectangular**.
5. Back Panel: **Stainless-steel** wall plate behind drinking fountain.
6. Bubblers: **Two**, with adjustable stream regulator, located on deck.
7. Control: **Push bar**]
8. Drain: Grid type with NPS 1-1/4 (DN 32) tailpiece.
9. Supply Piping: NPS 3/8 (DN 10) with shutoff valve.
10. Drain Piping: ASME A112.18.2/CSA B125.2, NPS 1-1/4 (DN 32) chrome-plated brass P-trap and waste.
11. Support: ASME A112.6.1M, Type III lavatory carrier.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in for water-supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before fixture installation.

B. Examine walls and floors for suitable conditions where fixtures will be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install fixtures level and plumb according to roughing-in drawings. For fixtures indicated for children, install at height required by authorities having jurisdiction.

B. Set pedestal drinking fountains on floor.

C. Install off-the-floor carrier supports, affixed to building substrate, for wall-mounted fixtures.

D. Install water-supply piping with shutoff valve on supply to each fixture to be connected to domestic-water distribution piping. Use ball or gate valve. Install valves in locations

where they can be easily reached for operation. Valves are specified in Section 220523.12 "Ball Valves for Plumbing Piping" and Section 220523.15 "Gate Valves for Plumbing Piping."

E. Install trap and waste piping on drain outlet of each fixture to be connected to sanitary drainage system.

F. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep-pattern escutcheons where required to conceal protruding fittings. Comply with escutcheon requirements specified in Section 220518 "Escutcheons for Plumbing Piping."

G. Seal joints between fixtures and walls using sanitary-type, one-part, mildew-resistant, silicone sealant. Match sealant color to fixture color. Comply with sealant requirements specified in Section 079200 "Joint Sealants."

H. Adjust fixture flow regulators for proper flow and stream height.

3.3 CONNECTIONS

A. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.

B. Comply with water piping requirements specified in Section 221116 "Domestic Water Piping."

C. Install ball or gate shutoff valve on water supply to each fixture. Comply with valve requirements specified in Section 220523.12 "Ball Valves for Plumbing Piping" and Section 220523.15 "Gate Valves for Plumbing Piping."

D. Comply with soil and waste piping requirements specified in Section 221316 "Sanitary Waste and Vent Piping."

3.4 CLEANING

A. After installation, inspect unit. Remove paint splatters and other spots, dirt, and debris. Repair damaged finish to match original finish.

B. Clean fixtures, on completion of installation, according to manufacturer's written instructions.

C. Provide protective covering for installed fixtures.

D. Do not allow use of fixtures for temporary facilities unless approved in writing by Owner.

END OF SECTION 224713

SECTION 230100
GENERAL REQUIREMENTS FOR HVAC

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes general requirements for HVAC work. Refer to architectural drawings, general notes, instructions to bidders, general conditions, supplementary general conditions, base building specifications and drawings, shop drawing manuals and as-built plans, except as noted herein, which apply in all respects to this section. The contractor shall visit the site and familiarize himself with all existing conditions prior to bidding the work.

1.02 USE OF DRAWINGS AND SPECIFICATIONS

A. EBS drawings and specifications are intended to convey design intent only. All means and methods sequences, techniques, and procedures of construction as well as any associated safety precautions and programs, and all incidental and temporary devices required to construct the project, and to provide a complete and fully operational mechanical system are the responsibility of the mechanical contractor.

1.03 STANDARDS

A. Equipment and materials shall conform with appropriate provisions of AGA, ARI, ASME, ASTM, CISPI, UL, NEMA, ANSI, SMACNA, ASHRAE, NFPA, NEC, as applicable to each individual unit or assembly. All equipment must bear UL label.

1.04 LICENSE/EXPERIENCE

A. Contractor must be licensed by the state to install HVAC systems/equipment. Contractor must also have a minimum of 5 years experience (unless stated otherwise in other sections) and have at least (5) successful project installations of similar size and scope. References must be provided upon request.

1.05 CODES

A. All work shall be performed in strict accordance with all applicable state and local codes and ordinances. The mechanical contractor shall satisfy code requirements at a minimum without any extra cost to the owner. In case of conflict between the drawings/specifications and the codes and ordinances, the highest standard shall apply.

1.06 PERMITS AND FEES

A. The mechanical contractor shall procure and pay for all permits, fees, taxes and inspections necessary to complete the mechanical work. Furnish certificate of approval for work from inspection authority to owner before final acceptance for work. Certificate of final inspection and approval shall be submitted with the contractor’s request for payment. No final payment will be approved without this certificate.

1.07 SITE EXAMINATION

A. The mechanical contractor shall thoroughly examine all areas of work where equipment, ductwork, and piping will be installed and shall report any condition that, in his opinion, prevents the proper installation of the mechanical work prior to bid, purchasing equipment, purchasing materials, and construction. Contractor shall also examine the drawings and specifications of other branches of work, making reference to them for details of new or existing building conditions. No extras will be allowed for failure to include all required work in bid.

B. All work shall be done at times convenient to the owner and only during normal working hours, unless specified otherwise.

C. Mechanical contractor shall take their own measurements and be responsible for them.

D. Access panels are not shown on drawings. During site examination, contractor shall identify all areas where access panels are required, and report to general contractor. Designation of who furnishes and who installs access panels must be coordinated with general contractor prior to starting work.

1.08 CONTRACTOR COORDINATION

A. Coordination drawings showing system and component installation layout, routing, details, etc. Shall be produced by the mechanical contractor and under the supervision of the general contractor/construction manager, or appropriate party as applicable.

B. All systems installed by each sub-contractor shall be coordinated with one another and approved by general contractor/construction manager, etc. prior to installation and/or fabrication.

C. If questions concerning design intent arise during coordination, EBS can assist where appropriate.

D. The architectural drawings shall take precedence over all other drawings. Do not scale distances off the mechanical drawings; use actual building dimensions.

PART 2 - PRODUCTS

2.01 SHOP DRAWINGS

A. Submit to the architect electronic copies of complete and certified shop drawings, descriptive data, performance data and ratings, diagrams and specifications on all specified equipment, including accessories, and materials for review. The make, model number, type, finish and accessories of all equipment and materials shall be reviewed and approved by the mechanical contractor and general contractor prior to submitting to the architect for their review and approval. Approval of shop drawings does not relieve the mechanical contractor/ vendor from compliance with the requirements of the contract drawings, specifications, and applicable codes.

B. Shop drawings shall be required on the following:
   1. HVAC equipment
   2. Fans

3. Diffusers, registers, grilles, dampers, and all sheet metal accessories
4. Temperature controls
5. HVAC coordination drawings including but not limited to ductwork, piping, etc.
6. Duct/pipe/insulation
7. Air control accessories (dampers, vanes, doors, connectors, etc.)

Products installed by the mechanical contractor and provided by others must be submitted for review prior to purchasing. Products shall not be selected based on permit drawings without express permission - products shall be selected based on construction drawings.

2.02 RECORD DRAWINGS

A. The mechanical contractor shall be responsible for creating coordination and record drawings. Drawings shall be produced in AUTOCAD 2004 format or later. Coordinate exact format with architect of record.

2.03 STARTUP AND TESTING

A. All mechanical systems and associated components shall go through start-up and be tested for proper operation per the manufacturer recommendations and industry standards. Startup to include factory trained personnel. Provide a copy of all start-up and testing paperwork to owner.

2.04 FIRE STOPPING

A. Provide fire stopping at all penetrations through rated separations per local codes & regulations & per UL recommendations for assemblies encountered in project.

B. The fire stopping material shall meet the integrity of the fire rated wall, floor, ceiling & roof being penetrated. Refer to architect's drawings for wall, floor, ceiling & roof fire ratings prior to bidding work.

C. Refer to architect's drawings for wall, floor, ceiling, and roof fire ratings prior to bidding work.

2.05 ACCESS PANELS

A. Provide ceiling and wall access panel quantities & locations to the general contractor prior to bidding. Access panels are required for all concealed appliances, controls devices, heat exchangers and HVAC system components that utilize energy. Where access panels are used, the access panel should be sized to allow accessibility for inspection, service, repair and replacement without disabling the function of a fire-resistance-rated assembly or removing permanent construction, other appliances, venting systems or any other piping or ducts not connected to the appliance being inspected, serviced, repaired or replaced. There shall be no extras for having to add access panels after bids are awarded.

2.06 CUTTING AND PATCHING

A. Neatly do all cutting as required and patch all cut surfaces to match building construction. The contractor shall employ and pay a trade trained and qualified contractor to perform the required patching work. All surfaces disturbed shall be restored with like materials

to the satisfaction of the owner. All penetrations through roof shall be made by bonded roofer. Mechanical contractor shall pay all fees required.

2.07 FLASHING AND COUNTERFLASHING

A. Roof flashing shall be furnished and installed by the roofing contractor. Roof counterflashing shall be furnished and installed by the mechanical contractor. Coordinate work with roofing contractor and pay all fees.

B. Obtain approval from general contractor, construction manager, owner and/or roofing contractor prior to making any penetrations so that warranties are not compromised or voided.

2.08 WARRANTY

A. The mechanical contractor shall unconditionally warrant all work to be free of defects in equipment, material and workmanship. The mechanical contractor will repair or replace any defective work promptly and without charge to the owner.

B. Restore any other existing work damaged while repairing defective equipment, materials and workmanship.

PART 3 - EXECUTION

3.01 MECHANICAL WORK

A. The mechanical contractor shall provide new HVAC equipment, fans, ductwork, piping, air devices, controls as indicated on drawings and as specified. Equipment and appliances shall be installed as required by the terms of their approval, in accordance with the conditions of the listing, the manufacturer's installation instructions, and applicable code.

3.02 OWNER'S INSTRUCTIONS

A. Provide two sets of complete operating and maintenance instructions with drawings, typewritten instructions, and operating sequences and descriptive data sheets. Assemble each set in a hard bound cover. Provide PDF files of all documentation.

3.03 FINALE

A. Put all equipment in service and demonstrate that all conditions of the contract have been fulfilled. Remove all tools, debris, etc. occasioned by work under this contract. Submit all warranties, test reports, operating and maintenance manuals for HVAC systems, log sheets and charts, and guarantees as previously specified. Provide all reports, forms, etc. required by inspectors to the satisfaction of the owner. Provide as-built record drawings (in AUTOCAD 2004 or later) showing an accurate account of the final installed systems. Systems including but not limited to all equipment and associated controls, ductwork/piping, air devices, etc.

END OF SECTION 230100

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SECTION 230513
COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes general requirements for single-phase and polyphase, general-purpose, horizontal, small and medium, squirrel-cage induction motors for use on ac power systems up to 600 V and installed at equipment manufacturer's factory or shipped separately by equipment manufacturer for field installation.

1.02 COORDINATION

A. Coordinate features of motors, installed units, and accessory devices to be compatible with the following:

1. Motor controllers.
2. Torque, speed, and horsepower requirements of the load.
3. Ratings and characteristics of supply circuit and required control sequence.
4. Ambient and environmental conditions of installation location.

PART 2 - PRODUCTS

2.01 GENERAL MOTOR REQUIREMENTS

A. Comply with NEMA MG 1 unless otherwise indicated.

2.02 MOTOR CHARACTERISTICS

A. Duty: Continuous duty at ambient temperature of 104 deg F and at altitude of 3300 feet sea level.

B. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.

2.03 POLYPHASE MOTORS

A. Description: NEMA MG 1, Design B, medium induction motor.

B. Efficiency: Energy efficient, as defined in NEMA MG 1.

C. Service Factor: 1.15.

D. Multispeed Motors: Variable torque.

1. For motors with 2:1 speed ratio, consequent pole, single winding.
2. For motors with other than 2:1 speed ratio, separate winding for each speed.

E. Rotor: Random-wound, squirrel cage.

F. Bearings: Regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading.

G. Temperature Rise: Match insulation rating.

H. Insulation: Class F.

I. Code Letter Designation:

1. Motors 15 HP and Larger: NEMA starting Code F or Code G.
2. Motors Smaller than 15 HP: Manufacturer's standard starting characteristic.

J. Enclosure Material: Cast iron for motor frame sizes 324T and larger; rolled steel for motor frame sizes smaller than 324T.

2.04 POLYPHASE MOTORS WITH ADDITIONAL REQUIREMENTS

A. Motors Used with Reduced-Voltage and Multispeed Controllers: Match wiring connection requirements for controller with required motor leads. Provide terminals in motor terminal box, suited to control method.

B. Motors Used with Variable Frequency Controllers: Ratings, characteristics, and features coordinated with and approved by controller manufacturer.

1. Windings: Copper magnet wire with moisture-resistant insulation varnish, designed and tested to resist transient spikes, high frequencies, and short time rise pulses produced by pulse-width modulated inverters.
2. Energy- and Premium-Efficient Motors: Class B temperature rise; Class F insulation.
3. Inverter-Duty Motors: Class F temperature rise; Class H insulation.
4. Thermal Protection: Comply with NEMA MG 1 requirements for thermally protected motors.

2.05 SINGLE-PHASE MOTORS

A. Motors larger than 1/20 hp shall be one of the following, to suit starting torque and requirements of specific motor application:

1. Permanent-split capacitor.
2. Split phase.
3. Capacitor start, inductor run.
4. Capacitor start, capacitor run.

B. Multispeed Motors: Variable-torque, permanent-split-capacitor type.

C. Bearings: Prelubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.

D. Motors 1/20 HP and Smaller: Shaded-pole type.

E. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.

PART 3 - **EXECUTION** (Not Applicable)

END OF SECTION 230513

SECTION 230529
HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.01 SUMMARY

A. Furnish and install hot-dipped galvanized steel fastener systems, hangers/supports, anchors, rods, straps, trim, and angles for support of equipment.

1.02 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design equipment hangers and supports, including comprehensive engineering analysis by a qualified professional, using performance requirements and design criteria indicated.

B. Structural Performance: Hangers and supports for HVAC equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.

1. Design equipment hangers and supports capable of supporting combined operating weight of supported equipment and connected systems and components.

1.03 SUBMITTALS

A. Refer to specification 230100 – General Requirements for HVAC.

1.04 QUALITY ASSURANCE

A. Structural Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

PART 2 - EXECUTION

2.01 HANGER AND SUPPORT INSTALLATION

A. Metal Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.

B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.

C. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.

D. Fastener System Installation:

1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches thick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.
2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

E. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.

F. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

G. Install lateral bracing with hangers and supports to prevent swaying.

H. Load Distribution: Install hangers and supports so that live and dead loads and stresses from movement will not be transmitted.

I. Insulated Piping:

1. Attach clamps and spacers to piping.

2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.

3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.

4. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

END OF SECTION 230529

SECTION 230553
IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Equipment labels.
2. Warning signs and labels.
3. Pipe labels.
4. Duct labels.

1.02 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.01 EQUIPMENT LABELS

A. Metal Labels for Equipment:
1. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Plastic Labels for Equipment:
1. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

C. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), and the Specification Section number and title where equipment is specified.

D. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch bond paper. Tabulate equipment identification number, and identify Drawing numbers where equipment is indicated (plans, details, and schedules) and the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2.02 WARNING SIGNS AND LABELS

A. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Label Content: Include caution and warning information plus emergency notification instructions.

2.03 PIPE LABELS

A. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.

B. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings; also include pipe size and an arrow indicating flow direction.

1. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions or as separate unit on each pipe label to indicate flow direction.

2.04 DUCT LABELS

A. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Duct Label Contents: Include identification of duct service using same designations or abbreviations as used on Drawings; also include duct size and an arrow indicating flow direction.

1. Flow-Direction Arrows: Integral with duct system service lettering to accommodate both directions or as separate unit on each duct label to indicate flow direction.

PART 3 - EXECUTION

3.01 PREPARATION

A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.02 EQUIPMENT LABEL INSTALLATION

A. Install or permanently fasten labels on each major item of mechanical equipment.

B. Locate equipment labels where accessible and visible.

3.03 PIPE LABEL INSTALLATION

A. Pipe Label Locations: Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:

1. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.

2. At access doors, manholes, and similar access points that permit view of concealed piping.
3. Near major equipment items and other points of origination and termination.

B. Pipe Label Color Schedule:
1. Condenser-Water Piping: **White letters on a safety-green background**
2. Refrigerant Piping: **Black letters on a safety-orange background**

3.04 DUCT LABEL INSTALLATION

A. Install self-adhesive duct labels with permanent adhesive on air ducts in the following color codes:

1. **Blue**: For cold-air supply ducts.
2. Yellow: For hot-air supply ducts.
3. Green: For exhaust-, outside-, relief-, return-, and mixed-air ducts.

B. Locate labels near points where ducts enter into and exit from concealed spaces and at maximum intervals of 50 feet in each space where ducts are exposed or concealed by removable ceiling system.

END OF SECTION 230553

SECTION 230529
HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 4 - GENERAL

4.01 SUMMARY

A. Furnish and install hot-dipped galvanized steel fastener systems, hangers/supports, anchors, rods, straps, trim, and angles for support of equipment.

4.02 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design equipment hangers and supports, including comprehensive engineering analysis by a qualified professional, using performance requirements and design criteria indicated.

B. Structural Performance: Hangers and supports for HVAC equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.

1. Design equipment hangers and supports capable of supporting combined operating weight of supported equipment and connected systems and components.

4.03 SUBMITTALS

A. Refer to specification 230100 – General Requirements for HVAC.

4.04 QUALITY ASSURANCE

A. Structural Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

PART 5 - EXECUTION

5.01 HANGER AND SUPPORT INSTALLATION

A. Metal Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.

B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.

C. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.

D. Fastener System Installation:

1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches thick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.
2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

E. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.

F. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

G. Install lateral bracing with hangers and supports to prevent swaying.

H. Load Distribution: Install hangers and supports so that live and dead loads and stresses from movement will not be transmitted.

I. Insulated Piping:

1. Attach clamps and spacers to piping.

2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.

3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.

4. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

END OF SECTION 230529

SECTION 230593
TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Balancing Air Systems:
      a. Constant-volume air systems.

1.02 DEFINITIONS

A. AABC: Associated Air Balance Council.

B. NEBB: National Environmental Balancing Bureau.

C. TAB: Testing, adjusting, and balancing.

D. TABB: Testing, Adjusting, and Balancing Bureau.

E. TAB Specialist: An entity engaged to perform TAB Work.

1.03 SUBMITTALS

A. Refer to specification 230100 – General Requirements for HVAC.

1.04 QUALITY ASSURANCE

A. TAB Contractor Qualifications: Engage a TAB entity certified by AABC or NEBB.

B. Certify TAB field data reports and perform the following:
   1. Review field data reports to validate accuracy of data and to prepare certified TAB reports.
   2. Certify that the TAB team complied with the approved TAB plan and the procedures specified and referenced in this Specification.

C. Instrumentation Type, Quantity, Accuracy, and Calibration: As described in ASHRAE 111, Section 5, "Instrumentation."

PART 2 - **PRODUCTS** (Not Applicable)

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems' designs that may preclude proper TAB of systems and equipment.

B. Examine systems for installed balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers. Verify that locations of these balancing devices are accessible.

C. Examine the approved submittals for HVAC systems and equipment.

D. Examine design data including HVAC system descriptions, statements of design assumptions for environmental conditions and systems' output, and statements of philosophies and assumptions about HVAC system and equipment controls.

E. Examine equipment performance data including fan and pump curves.

1. Relate performance data to Project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.
2. Calculate system-effect factors to reduce performance ratings of HVAC equipment when installed under conditions different from the conditions used to rate equipment performance. To calculate system effects for air systems, use tables and charts found in AMCA 201, "Fans and Systems," or in SMACNA's "HVAC Systems - Duct Design." Compare results with the design data and installed conditions.

F. Examine system and equipment installations and verify that field quality-control testing, cleaning, and adjusting specified in individual Sections have been performed.

G. Examine test reports specified in individual system and equipment Sections.

H. Examine HVAC equipment and filters and verify that bearings are greased, belts are aligned and tight, and equipment with functioning controls is ready for operation.

I. Examine operating safety interlocks and controls on HVAC equipment.

J. Report deficiencies discovered before and during performance of TAB procedures. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.

3.02 GENERAL PROCEDURES FOR TESTING AND BALANCING

A. Perform testing and balancing procedures on each system according to the procedures contained in AABC's "National Standards for Total System Balance," NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems," and SMACNA's "HVAC Systems - Testing, Adjusting, and Balancing" and in this Section.

3.03 REPORTING

A. Initial Construction-Phase Report: Based on examination of the Contract Documents as specified in "Examination" Article, prepare a report on the adequacy of design for systems' balancing devices. Recommend changes and additions to systems' balancing devices to facilitate proper performance measuring and balancing. Recommend changes and additions to HVAC systems and general construction to allow access for performance measuring and balancing devices.

B. Include a list of deficiencies and problems found in systems being tested and balanced. Prepare a separate report for each system and each building floor for systems serving multiple floors if applicable.

3.04 FINAL REPORT

A. General: Prepare a certified written report; tabulate and divide the report into separate sections for tested systems and balanced systems.
   1. Include a certification sheet at the front of the report's binder, signed and sealed by the certified testing and balancing engineer.
   2. Include a list of instruments used for procedures, along with proof of calibration.

B. Final Report Contents: In addition to certified field-report data, include the following:
   1. Fan curves.
   2. Manufacturer’s test data.
   3. Field test reports prepared by system and equipment installers.
   4. Other information relative to equipment performance; do not include Shop Drawings and product data.

C. General Report Data: In addition to form titles and entries, include the following data:
   1. Title page.
   2. Name and address of the TAB contractor.
   3. Project name.
   4. Project location.
   5. Architect’s name and address.
   6. Engineer’s name and address.
   7. Contractor’s name and address.
   8. Report date.
   9. Signature of TAB supervisor who certifies the report.
   10. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.
   11. Summary of contents including the following:
      a. Indicated versus final performance.
      b. Notable characteristics of systems.
      c. Description of system operation sequence if it varies from the Contract Documents.
   12. Nomenclature sheets for each item of equipment.
   13. Notes to explain why certain final data in the body of reports vary from indicated values.

3.05 ADDITIONAL TESTS

A. Within 90 days of completing TAB, perform additional TAB to verify that balanced conditions are being maintained throughout and to correct unusual conditions.

B. Seasonal Periods: If initial TAB procedures were not performed during near-peak summer and winter conditions, perform additional TAB during near-peak summer and winter conditions.

END OF SECTION 230593

SECTION 230713
DUCT INSULATION

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes insulating the following duct services:

1. Indoor, concealed supply and outdoor air.
2. Indoor, concealed exhaust between isolation damper and penetration of building exterior.

1.02 SUBMITTALS

A. Refer to specification 230100 – General Requirements for HVAC.

1.03 QUALITY ASSURANCE

A. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84, by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.

1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

PART 2 - PRODUCTS

2.01 INSULATION MATERIALS

A. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II and ASTM C 1290, Type III with factory applied FSK jacket.

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. CertainTeed Corporation.
2. Johns Manville; a Berkshire Hathaway company.
3. Knauf Insulation.
4. Manson Insulation Inc.
5. Owens Corning.

2.02 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.

2.03 MASTICS/SEALENTS

A. Materials shall be compatible with insulation materials, jackets, and substrates. Seal all longitudinal and transverse joints with a UL 181A or 181B non-hardening mastic or liquid elastic sealant of a type recommended by the manufacturer for sealing joints and seams in sheet metal ductwork.

2.04 FACTORY-APPLIED JACKETS

A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:
   1. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.

2.05 TAPES

A. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136.

B. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.

PART 3 - EXECUTION

3.01 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

3.02 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of ducts and fittings.

B. Install insulation materials, vapor barriers or retarders, jackets, and thicknesses required for each item of duct system as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Keep insulation materials dry during application and finishing.

G. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

H. Install insulation with least number of joints practical.

I. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.

1. Install insulation continuously through hangers and around anchor attachments.
2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.

J. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

K. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

L. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

M. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

3.03 PENETRATIONS

A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
4. Seal jacket to roof flashing with flashing sealant.

B. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.

1. Seal penetrations with flashing sealant.

2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
4. Seal jacket to wall flashing with flashing sealant.

C. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

D. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Terminate insulation at fire damper sleeves for fire-rated wall and partition penetrations. Externally insulate damper sleeves to match adjacent insulation and overlap duct insulation at least 2 inches.

3.04 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:

1. Inspect ductwork, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to [**one**] <**Insert number**> location(s) for each duct system defined in the "Duct Insulation Schedule, General" Article.

C. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.05 DUCT INSULATION SCHEDULE, GENERAL

A. Refer to Duct Insulation Schedule on sheet M200 for additional details.

END OF SECTION 230713

SECTION 230719
HVAC PIPING INSULATION

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes insulating the following HVAC piping systems:
   1. Refrigerant suction and hot-gas piping, indoor and outdoor.

B. Related Sections:

   1. Section 230713 "Duct Insulation."
   2. Section 230716 "HVAC Equipment Insulation."

1.02 ACTION SUBMITTALS

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

B. LEED Submittals:

   1. Product Data for Credit IEQ 4.1: For adhesives and sealants, documentation including printed statement of VOC content.
   2. Laboratory Test Reports for Credit IEQ 4: For adhesives and sealants, documentation indicating that products comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

1.03 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.04 QUALITY ASSURANCE

A. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.

   1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
   2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

PART 2 - PRODUCTS

2.01 INSULATION MATERIALS

A. Products shall not contain asbestos, lead, mercury, or mercury compounds.

B. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.

2.02 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.

B. Flexible Elastomeric and Polyolefin Adhesive: Comply with MIL-A-24179A, Type II, Class I.

C. ASJ Adhesive, and FSK and PVDC Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.

2.03 SEALANTS

A. Joint Sealants:

1. Materials shall be compatible with insulation materials, jackets, and substrates.
2. Permanently flexible, elastomeric sealant.
3. Service Temperature Range: Minus 100 to plus 300 deg F.

B. FSK and Metal Jacket Flashing Sealants:

1. Materials shall be compatible with insulation materials, jackets, and substrates.
2. Fire- and water-resistant, flexible, elastomeric sealant.
3. Service Temperature Range: Minus 40 to plus 250 deg F.

PART 3 - EXECUTION

3.01 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

3.02 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping including fittings, valves, and specialties.

B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of pipe system as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.

G. Keep insulation materials dry during application and finishing.

H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

I. Install insulation with least number of joints practical.

J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.

1. Install insulation continuously through hangers and around anchor attachments.
2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.

K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

L. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

M. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

N. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

3.03 PENETRATIONS

A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
4. Seal jacket to roof flashing with flashing sealant.

B. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

C. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.

1. Comply with requirements in Section 078413 "Penetration Firestopping" for firestopping and fire-resistive joint sealers.

D. Insulation Installation at Floor Penetrations:

1. Pipe: Install insulation continuously through floor penetrations.
2. Seal penetrations through fire-rated assemblies. Comply with requirements in Section 078413 "Penetration Firestopping."

3.04 INSTALLATION OF FLEXIBLE ELASTOMERIC INSULATION

A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

B. Insulation Installation on Pipe Flanges:

1. Install pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as pipe insulation.
4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install mitered sections of pipe insulation.

2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed valve covers manufactured of same material as pipe insulation when available.
2. When preformed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.
4. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.05 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:

1. Inspect pipe, fittings, strainers, and valves, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to [**three**] <**Insert number**> locations of straight pipe, [**three**] <**Insert number**> locations of threaded fittings, [**three**] <**Insert number**> locations of welded fittings, [**two**] <**Insert number**> locations of threaded strainers, [**two**] <**Insert number**> locations of welded strainers, [**three**] <**Insert number**> locations of threaded valves, and [**three**] <**Insert number**> locations of flanged valves for each pipe service defined in the "Piping Insulation Schedule, General" Article.

C. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.06 PIPING INSULATION SCHEDULE, GENERAL

A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.

B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:

1. Drainage piping located in crawl spaces.
2. Underground piping.
3. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

END OF SECTION 230719

SECTION 230800
COMMISSIONING OF HVAC

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes commissioning process requirements for HVAC&R systems, assemblies, and equipment.

B. Related Sections:

1. Section 019113 "General Commissioning Requirements" for general commissioning process requirements.

1.02 DEFINITIONS

A. Commissioning Plan: A document that outlines the organization, schedule, allocation of resources, and documentation requirements of the commissioning process.

B. CxA: Commissioning Authority.

C. HVAC&R: Heating, Ventilating, Air Conditioning, and Refrigeration.

D. Systems, Subsystems, Equipment, and Components: Where these terms are used together or separately, they shall mean "as-built" systems, subsystems, equipment, and components.

1.03 INFORMATIONAL SUBMITTALS

A. Certificates of readiness.

B. Certificates of completion of installation, prestart, and startup activities.

1.04 CONTRACTOR'S RESPONSIBILITIES

A. Perform commissioning tests at the direction of the CxA.

B. Attend construction phase controls coordination meeting.

C. Attend testing, adjusting, and balancing review and coordination meeting.

D. Participate in HVAC&R systems, assemblies, equipment, and component maintenance orientation and inspection as directed by the CxA.

E. Provide information requested by the CxA for final commissioning documentation.

F. Provide measuring instruments and logging devices to record test data, and provide data acquisition equipment to record data for the complete range of testing for the required test period.

1.05 COMMISSIONING DOCUMENTATION

A. Provide the following information to the CxA for inclusion in the commissioning plan:

1. Plan for delivery and review of submittals, systems manuals, and other documents and reports.
2. Identification of installed systems, assemblies, equipment, and components including design changes that occurred during the construction phase.
3. Process and schedule for completing construction checklists and manufacturer's prestart and startup checklists for HVAC&R systems, assemblies, equipment, and components to be verified and tested.
4. Certificate of readiness, signed by the Contractor, certifying that HVAC&R systems, assemblies, equipment, components, and associated controls are ready for testing.
5. Certificate of completion certifying that installation, prestart checks, and startup procedures have been completed.
6. Certificate of readiness certifying that HVAC&R systems, subsystems, equipment, and associated controls are ready for testing.
7. Test and inspection reports and certificates.
8. Corrective action documents.
9. Verification of testing, adjusting, and balancing reports.

PART 2 - **PRODUCTS** (Not Used)

PART 3 - EXECUTION

3.01 TESTING PREPARATION

A. Certify that HVAC&R systems, subsystems, and equipment have been installed, calibrated, and started and are operating according to the Contract Documents.

B. Certify that HVAC&R instrumentation and control systems have been completed and calibrated, that they are operating according to the Contract Documents, and that pretest set points have been recorded.

C. Certify that testing, adjusting, and balancing procedures have been completed and that testing, adjusting, and balancing reports have been submitted, discrepancies corrected, and corrective work approved.

D. Set systems, subsystems, and equipment into operating mode to be tested (e.g., normal shutdown, normal auto position, normal manual position, unoccupied cycle, emergency power, and alarm conditions).

E. Inspect and verify the position of each device and interlock identified on checklists.

F. Check safety cutouts, alarms, and interlocks with smoke control and life-safety systems during each mode of operation.

G. Testing Instrumentation: Install measuring instruments and logging devices to record test data as directed by the CxA.

3.02 Testing AND BALANCING VERIFICATION

A. Prior to performance of testing and balancing Work, provide copies of reports, sample forms, checklists, and certificates to the CxA.

B. Notify the CxA at least 10 days in advance of testing and balancing Work, and provide access for the CxA to witness testing and balancing Work.

C. Provide technicians, instrumentation, and tools to verify testing and balancing of HVAC&R systems at the direction of the CxA.

1. The CxA will notify testing and balancing contractor/subcontractor in advance of the date of field verification. Notice will not include data points to be verified.
2. The testing and balancing contractor shall use the same instruments (by model and serial number) that were used when original data were collected.
3. Failure of an item includes, other than sound, a deviation of more than 10 percent. Failure of more than 10 percent of selected items shall result in rejection of final testing, adjusting, and balancing report. For sound pressure readings, a deviation of 3 dB shall result in rejection of final testing. Variations in background noise must be considered.
4. Remedy the deficiency and notify the CxA so verification of failed portions can be performed.

3.03 GENERAL TESTING REQUIREMENTS

A. Provide technicians, instrumentation, and tools to perform commissioning test at the direction of the CxA.

B. Scope of HVAC&R testing shall include entire HVAC&R installation, from central equipment for heat generation and refrigeration through distribution systems to each conditioned space. Testing shall include measuring capacities and effectiveness of operational and control functions.

C. Test all operating modes, interlocks, control responses, and responses to abnormal or emergency conditions, and verify proper response of building automation system controllers and sensors.

D. The CxA along with the HVAC&R contractor/subcontractor, testing and balancing contractor/subcontractor, and HVAC&R Instrumentation and Control contractor/subcontractor shall prepare detailed testing plans, procedures, and checklists for HVAC&R systems, subsystems, and equipment.

E. Tests will be performed using design conditions whenever possible.

F. Simulated conditions may need to be imposed using an artificial load when it is not practical to test under design conditions. Before simulating conditions, calibrate testing instruments. Provide equipment to simulate loads. Set simulated conditions as directed by the CxA and document simulated conditions and methods of simulation. After tests, return settings to normal operating conditions.

G. The CxA may direct that set points be altered when simulating conditions is not practical.

H. The CxA may direct that sensor values be altered with a signal generator when design or simulating conditions and altering set points are not practical.

I. If tests cannot be completed because of a deficiency outside the scope of the HVAC&R system, document the deficiency and report it to the Owner. After deficiencies are resolved, reschedule tests.

J. If the testing plan indicates specific seasonal testing, complete appropriate initial performance tests and documentation and schedule seasonal tests.

3.04 HVAC&R systems, subsystems, and equipment Testing Procedures

A. HVAC&R Instrumentation and Control System Testing: Field testing plans and testing requirements are specified in Section 230923 "Direct Digital Control (DDC) System for HVAC" and Section 230993.11 "Sequence of Operations for HVAC DDC." Assist the CxA with preparation of testing plans.

B. Pipe system cleaning, flushing, hydrostatic tests, and chemical treatment requirements are specified in HVAC piping Sections. HVAC&R contractor/subcontractor prepare a pipe system cleaning, flushing, and hydrostatic testing plan. Provide cleaning, flushing, testing, and treating plan and final reports to the CxA. Plan shall include the following:

1. Sequence of testing and testing procedures for each section of pipe to be tested, identified by pipe zone or sector identification marker. Markers shall be keyed to Drawings for each pipe sector, showing the physical location of each designated pipe test section. Drawings keyed to pipe zones or sectors shall be formatted to allow each section of piping to be physically located and identified when referred to in pipe system cleaning, flushing, hydrostatic testing, and chemical treatment plan.
2. Description of equipment for flushing operations.
3. Minimum flushing water velocity.
4. Tracking checklist for managing and ensuring that all pipe sections have been cleaned, flushed, hydrostatically tested, and chemically treated.

C. Energy Supply System Testing: Provide technicians, instrumentation, tools, and equipment to test performance of gas systems and equipment at the direction of the CxA. The CxA shall determine the sequence of testing and testing procedures for each equipment item and pipe section to be tested.

D. Refrigeration System Testing: Provide technicians, instrumentation, tools, and equipment to test performance of chillers, cooling towers, refrigerant compressors and condensers, heat pumps, and other refrigeration systems. The CxA shall determine the

sequence of testing and testing procedures for each equipment item and pipe section to be tested.

E. HVAC&R Distribution System Testing: Provide technicians, instrumentation, tools, and equipment to test performance of air, steam, and hydronic distribution systems; special exhaust; and other distribution systems, including HVAC&R terminal equipment and unitary equipment.

F. Vibration and Sound Tests: Provide technicians, instrumentation, tools, and equipment to test performance of vibration isolation and seismic controls.

END OF SECTION 230800

SECTION 230923.16
GAS INSTRUMENTS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes the Following Gas Instruments:

1. Carbon-dioxide sensors and transmitters.

1.02 DEFINITIONS

A. NDIR: Nondispersive infrared.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. LEED Submittals: Product data of carbon-dioxide instruments for use in showing compliance with requirements in ASHRAE 62.1.

C. Shop Drawings:

1. Include plans, elevations, sections, and [**mounting**] details.
2. Include diagrams for power, signal, and control wiring.
3. Number-coded identification system for unique identification of wiring, cable, and tubing ends.

PART 2 - PRODUCTS

2.01 CARBON-DIOXIDE SENSORS AND TRANSMITTERS

A. Description:

1. NDIR technology or equivalent technology providing long-term stability and reliability.
2. Two-wire, 4-20 mA output signal, linearized to carbon-dioxide concentration in ppm.

B. Construction:

1. House electronics in an ABS plastic enclosure. Provide equivalent of NEMA 250, Type 1 enclosure for wall-mounted space applications and NEMA 250, Type 4 for duct-mounted applications.
2. Equip with digital display for continuous indication of carbon-dioxide concentration.

C. Performance:

1. Measurement Range: Zero to 2000 ppm.
2. Accuracy: Within 2 percent of reading, plus or minus 30 ppm.
3. Repeatability: Within 1 percent of full scale.
4. Temperature Dependence: Within 0.05 percent of full scale over an operating range of 25 to 110 deg.
5. Long-Term Stability: Within 5 percent of full scale after more than five years.

D. Provide calibration kit. Turn over to Owner at start of warranty period.

PART 3 - EXECUTION

3.01 INSTALLATION, GENERAL

A. Furnish and install products required to satisfy more stringent of all requirements indicated.

B. Install products level, plumb, parallel, and perpendicular with building construction.

C. Properly support instruments, tubing, piping, wiring, and conduit to comply with requirements indicated. Brace all products to prevent lateral movement and sway or a break in attachment when subjected to seismic loads.

D. Install products in locations that are accessible and that permit calibration and maintenance from floor, equipment platforms, or catwalks. Where ladders are required for Owner's access, confirm unrestricted ladder placement is possible under occupied condition.

3.02 ELECTRICAL POWER

A. Furnish and install electrical power to products requiring electrical connections.

3.03 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Each piece of wire, cable, and tubing shall have the same designation at each end for operators to determine continuity at points of connection. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

B. Install engraved phenolic nameplate with instrument identification on face.

3.04 CHECKOUT PROCEDURES

A. Check out installed products before continuity tests, leak tests, and calibration.

B. Check instruments for proper location and accessibility.

C. Check instruments for proper installation on direction of flow, elevation, orientation, insertion depth, or other applicable considerations that impact performance.

D. Check instrument tubing for proper isolation, fittings, slope, dirt legs, drains, material, and support.

END OF SECTION 230923.16

SECTION 230993.11
SEQUENCE OF OPERATIONS FOR HVAC

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes control sequences for HVAC systems, subsystems, and equipment.

1.02 GAS FURNANCE SPLIT SYSTEM (GF/CU-2A/2B/2C/2D/2E/3B/3C)

A. General

1. Heating Mode

a. Indoor furnaces shall be controlled from a thermostat in the space. When the thermostat calls for heating the fan shall run and the gas fired heat exchanger shall fire to maintain temperature setpoint. When the setpoint is reached the unit shall shut off.

2. Cooling mode

a. When the thermostat calls for cooling the condensing unit shall engage, the air handler fan shall run, and the DX cooling coil shall cool the air to maintain temperature setpoint. When the setpoint is reached the condensing unit shall shut off.

3. Ventilation

a. The furnace fan will pull in fresh air per the 2015 OMC section 403 building ventilation air.

4. Temperature Setpoint

a. Cooling: 70° F (adjustable)
b. Heating: 72° F (adjustable)

1.03 GAS FURNANCE SPLIT SYSTEM (GF/CU-3A)

A. General

1. Heating Mode

a. Indoor furnaces shall be controlled from a thermostat in the space. When the thermostat calls for heating the fan shall run and the gas fired heat exchanger shall fire to maintain temperature setpoint. When the setpoint is reached the unit shall shut off.

2. Cooling mode

a. When the thermostat calls for cooling the condensing unit shall engage, the air handler fan shall run, and the DX cooling coil shall cool the air to maintain

temperature setpoint. When the setpoint is reached the condensing unit shall shut off.

3. Ventilation

   a. CO2 MONITORING
      1) Install carbon dioxide (CO2) sensor in the main return duct. CO2 sensor will communicate to control panel then Economizer damper shall open to minimum position of 10% airflow when CO2 concentration are below 1,000 PPM (adjustable). If levels exceed 1,000 PPM damper shall open to design ventilation air quantity.

4. Temperature Setpoint

   a. Cooling: 70° F (adjustable)
   b. Heating: 72° F (adjustable)

1.04 GAS FIRED VTAC (GF/CU-2A/2B/2C/2D/2E/3B/3C)

A. General

1. Heating Mode

   a. Indoor furnaces shall be controlled from a thermostat in the space. When the thermostat calls for heating the fan shall run and the gas fired heat exchanger shall fire to maintain temperature setpoint. When the setpoint is reached the unit shall shut off.

2. Cooling mode

   a. When the thermostat calls for cooling the condensing unit shall engage, the air handler fan shall run, and the DX cooling coil shall cool the air to maintain temperature setpoint. When the setpoint is reached the condensing unit shall shut off.

3. Ventilation

   a. The furnace fan will pull in fresh air per the 2015 OMC section 403.3.2 building ventilation air.

4. Temperature Setpoint

   a. Cooling: 70° F (adjustable)
   b. Heating: 72° F (adjustable)

1.05 EXHAUST FANS

A. E-1: Exhaust fan shall run continuously at low speed and ramp up to high speed when switch is turn on.

B. E-2/3: Exhaust fan to run on a switch.

C. E-4/5: Exhaust fan to run continuously.

PART 2 - **PRODUCTS** (Not Applicable)

PART 3 - **EXECUTION** (Not Applicable)

END OF SECTION 230993.11

SECTION 233113
METAL DUCTS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Rectangular ducts and fittings.
2. Round ducts and fittings.
3. Sheet metal materials.
4. Sealants and gaskets.
5. Hangers and supports.

1.02 PERFORMANCE REQUIREMENTS

A. Delegated Duct Design: Duct construction, including sheet metal thicknesses, seam and joint construction, reinforcements, and hangers and supports, shall comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

B. Structural Performance: Duct hangers and supports shall withstand the effects of gravity loads and stresses within limits and under conditions described in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible".

1.03 SUBMITTALS

A. Refer to specification 230100 – General Requirements for HVAC.

PART 2 - PRODUCTS

2.01 RECTANGULAR DUCTS AND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.

B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-1, "Rectangular Duct/Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Duct/Longitudinal Seams," for static-pressure class, applicable sealing requirements,

materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

D. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 4, "Fittings and Other Construction," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.02 ROUND DUCTS AND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 3, "Round, Oval, and Flexible Duct," based on indicated static-pressure class unless otherwise indicated.

B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-1, "Round Duct Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-2, "Round Duct Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

D. Tees and Laterals: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.03 SHEET METAL MATERIALS

A. General Material Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.

C. General Material Requirements: Comply with SMACNA's "HVAC Duct Construction Standards. Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

D. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.

2.04 SEALANT AND GASKETS

A. General Sealant and Gasket Requirements: Ductwork to be sealed through the use of tapes, mastics, liquid sealants, gasketing, or other approved means to help limit air loss. Seal all ductwork, including supplies and return grilles, during construction to prevent dust and debris from entering the distribution system. Seal connections between ductwork/ equipment and ductwork/ air device/ drywall to maintain minimal duct leakage.

2.05 HANGERS AND SUPPORTS

A. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts.

B. Hanger Rods for Corrosive Environments: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.

C. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1 "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct."

D. Steel Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A 603.

E. Steel Cables for Stainless-Steel Ducts: Stainless steel complying with ASTM A 492.

F. Steel Cable End Connections: Cadmium-plated steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.

G. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.

H. Trapeze and Riser Supports:

1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.
2. Supports for Stainless-Steel Ducts: Stainless-steel shapes and plates.
3. Supports for Aluminum Ducts: Aluminum or galvanized steel coated with zinc chromate.

PART 3 - EXECUTION

3.01 DUCT INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of duct system. Indicated duct locations, configurations, and arrangements were used to size ducts and calculate friction loss for air-handling equipment sizing and for other design considerations. Install duct systems as indicated unless deviations to layout are approved on Shop Drawings and Coordination Drawings.

B. Install ducts according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" unless otherwise indicated.

C. Install round ducts in maximum practical lengths.

D. Install ducts with fewest possible joints.

E. Install factory- or shop-fabricated fittings for changes in direction, size, and shape and for branch connections.

F. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.

G. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.

H. Install ducts with a clearance of 1 inch, plus allowance for insulation thickness.

I. Route ducts to avoid passing through transformer vaults and electrical equipment rooms and enclosures.

J. Where ducts pass through non-fire-rated interior partitions and exterior walls and are exposed to view, cover the opening between the partition and duct or duct insulation with sheet metal flanges of same metal thickness as the duct. Overlap openings on four sides by at least 1-1/2 inches.

K. Where ducts pass through fire-rated interior partitions and exterior walls, install fire dampers. Comply with requirements in Section 233300 "Air Duct Accessories" for fire and smoke dampers.

L. Protect duct interiors from moisture, construction debris and dust, and other foreign materials.

3.02 DUCT SEALING

A. Seal ducts according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

3.03 HANGER AND SUPPORT INSTALLATION

A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 5, "Hangers and Supports."

3.04 CONNECTIONS

A. Make connections to equipment with flexible connectors complying with Section 233300 "Air Duct Accessories."

B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

3.05 START UP

A. Air Balance: Comply with requirements in Section 230593 "Testing, Adjusting, and Balancing for HVAC."

END OF SECTION 233113

SECTION 233116
NONMETAL DUCTS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Fibrous-glass ducts and fittings.
2. Phenolic-foam ducts and fittings.

B. Related Sections:

1. Section 230593 "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing requirements for nonmetal ducts.
2. Section 233113 "Metal Ducts" for single- and double-wall, rectangular and round ducts.
3. Section 233119 "HVAC Casings" for factory- and field-fabricated casings for mechanical equipment.
4. Section 233300 "Air Duct Accessories" for dampers, duct-mounting access doors and panels, turning vanes, and flexible ducts.

1.02 PERFORMANCE REQUIREMENTS

A. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

1.03 ACTION SUBMITTALS

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

B. LEED Submittals:

1. Product Data for Prerequisite IEQ 1: Documentation indicating that duct systems comply with ASHRAE 62.1, Section 5 - "Systems and Equipment."
2. Product Data for Prerequisite EA 2: Documentation indicating that duct systems comply with ASHRAE/IESNA 90.1, Section 6.4.4 - "HVAC System Construction and Insulation."
3. Duct-Cleaning Test Report for Prerequisite IEQ 1: Documentation of work performed for compliance with ASHRAE 62.1, Section 7.2.4 - "Ventilation System Start-up."
4. Product Data for Credit IEQ 4.1: For adhesives and sealants, documentation including printed statement of VOC content.

C. Shop Drawings:

1. Fabrication, assembly, and installation, including plans, elevations, sections, components, and attachments to other work.
2. Duct layout indicating sizes and pressure classes.
3. Elevation of top of ducts.
4. Dimensions of main duct runs from building grid lines.
5. Fittings.
6. Reinforcement and spacing.
7. Seam and joint construction.
8. Penetrations through fire-rated and other partitions.
9. Equipment installation based on equipment being used on Project.
10. Hangers and supports, including methods for duct and building attachment and vibration isolation.

1.04 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Duct installation in congested spaces, indicating coordination with general construction, building components, and other building services. Indicate proposed changes to duct layout.
2. Suspended ceiling components.
3. Structural members to which duct will be attached.
4. Size and location of initial access modules for acoustical tile.
5. Penetrations of smoke barriers and fire-rated construction.
6. Items penetrating finished ceiling including the following:

    a. Lighting fixtures.
    b. Air outlets and inlets.
    c. Speakers.
    d. Sprinklers.
    e. Access panels.
    f. Perimeter moldings.

1.05 QUALITY ASSURANCE

A. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and System Start-up."

B. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6.4.4 - "HVAC System Construction and Insulation."

C. NFPA Compliance:

1. NFPA 90A, "Installation of Air Conditioning and Ventilating Systems."
2. NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."

PART 2 - PRODUCTS

2.01 FIBROUS-GLASS DUCTS AND FITTINGS

A. Fibrous-Glass Duct Materials: Resin-bonded fiberglass, faced on the outside surface with fire-resistive FSK vapor retarder and with a smooth fiberglass mat finish on the air-side surface.

1. Duct Board: Factory molded into rectangular boards.
2. Round Duct: Factory molded into straight round duct and smooth fittings.
3. Temperature Limits: 40 to 250 deg F (5 to 121 deg C) inside ducts; 150 deg F (66 deg C) ambient temperature surrounding ducts.
4. Maximum Thermal Conductivity: [**0.24 Btu x in./h x sq. ft. x deg F (0.035 W/m x K)**] <**Insert conductivity**> at 75 deg F (24 deg C) mean temperature.
5. Moisture Absorption: Not exceeding 5 percent by weight at 120 deg F (49 deg C) and 95 percent relative humidity for 96 hours when tested according to ASTM C 1104/C 1104M.
6. Permeability: 0.02 perms (1.15 ng/Pa x s x sq. m) maximum when tested according to ASTM E 96/E 96M, Procedure A.
7. Antimicrobial Agent: Compound shall be tested for efficacy by an NRTL, and registered by the EPA for use in HVAC systems.
8. Noise-Reduction Coefficient: 0.65 minimum when tested according to ASTM C 423, Mounting A.
9. Required Markings: EI rating, UL label, and other markings required by UL 181 on each full sheet of duct board.

B. Closure Materials:

1. Pressure-Sensitive Tape: Comply with UL 181A; imprinted by the manufacturer with the coding "181A-P," the manufacturer's name, and a date code.

    a. Tape: Aluminum foil-scrim tape imprinted with listing information.
    b. Minimum Tape Width: 2-1/2 inches (64 mm); 3 inches (76 mm) for duct board thicker than 1 inch (25 mm).
    c. Staples: 1/2-inch (13-mm) outward clinching, 2 inches (51 mm) o.c. in tabs, one tab per joint.
    d. Water resistant.
    e. Mold and mildew resistant.

2. Heat-Activated Tape: Comply with UL 181A; imprinted by the manufacturer with the coding "181A-H," the manufacturer's name, and a date code.

    a. Tape: Aluminum foil-scrim tape imprinted with listing information.
    b. Minimum Tape Width: 3 inches (76 mm).
    c. Heat-Sensitive Imprint: Printed indicator on tape to show proper heating during application has been achieved.
    d. Water resistant.
    e. Mold and mildew resistant.

3. Two-Part Tape Sealing System: Comply with UL 181A; imprinted by the manufacturer with the coding "181A-M," the manufacturer's name, and a date code.

    a. Tape: Woven glass fiber impregnated with mineral gypsum.
    b. Minimum Tape Width: 3 inches (76 mm).
    c. Sealant: Modified styrene acrylic.
    d. Water resistant.
    e. Mold and mildew resistant.
    f. For indoor applications, sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
    g. Sealant shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

C. Fabrication:

1. Select joints, seams, transitions, elbows, and branch connections and fabricate according to [**SMACNA's "Fibrous Glass Duct Construction Standards," Chapter 2, "Specifications and Closure," and Chapter 4, "Fittings and Connections."**] [**NAIMA AH116, "Fibrous Glass Duct Construction Standards," Section II, "Fabrication of Straight Duct Modules," Section III, "Fabrication of Fittings from Modules or Flat Board," and Section IV, "Closure."**]
2. Fabricate 90-degree mitered elbows to include turning vanes.
3. Reinforcements: Comply with requirements in [**SMACNA's "Fibrous Glass Duct Construction Standards," Chapter 5, "Reinforcement"**] [**NAIMA AH116, "Fibrous Glass Duct Construction Standards," Section V, "Reinforcement"**] for channel- and tie-rod reinforcement materials, spacing, and fabrication.
4. Preformed Round Duct: Comply with NAIMA AH116, "Fibrous Glass Duct Construction Standards," Section VII, "Preformed Round Duct."

2.02 PHENOLIC-FOAM DUCTS AND FITTINGS

A. Duct Panel: CFC-free phenolic-foam bonded on both sides with factory-applied 0.001-inch- (0.025-mm-) thick, aluminum foil reinforced with fiberglass scrim.

1. Maximum Temperature: 158 deg F (70 deg C) inside ducts or ambient temperature surrounding ducts.
2. Maximum Thermal Conductivity: [**0.13 Btu x in./h x sq. ft. x deg F (0.019 W/m x K)**] <**Insert conductivity**> at 75 deg F (24 deg C) mean temperature.
3. Permeability: 0.0002 perms (0.0115 ng/Pa x s x sq. m) maximum when tested according to ASTM E 96/E 96M, Procedure A.
4. Antimicrobial Agent: Compound shall be tested for efficacy by an NRTL, and registered by the EPA for use in HVAC systems.
5. Noise-Reduction Coefficient: 0.65 minimum when tested according to ASTM C 423, Mounting A.
6. Required Markings: UL label and other markings required by UL 181 on each full sheet of duct panel; UL ratings for closure materials.

B. Closure Materials:

1. V-Groove Adhesive: Silicone.

   a. For indoor applications, sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
   b. Sealant shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2. Pressure-Sensitive Tape: Comply with UL 181A; imprinted by the manufacturer with the coding "181A-P," the manufacturer's name, and a date code.

   a. Tape: Aluminum foil tape imprinted with listing information.
   b. Minimum Tape Width: 3 inches (76 mm).
   c. Water resistant.
   d. Mold and mildew resistant.

3. Polymeric Sealing System:

   a. Structural Membrane: Woven glass fiber.
   b. Minimum Tape Width: 3 inches (76 mm).
   c. Sealant: Water based.
   d. Color: White.
   e. Water resistant.
   f. Mold and mildew resistant.
   g. For indoor applications, sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
   h. Sealant shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

C. Fabrication:

1. Fabricate joints, seams, transitions, reinforcement, elbows, branch connections, access doors and panels, and damage repairs according to Knauf Insulation's "Knauf KoolDuct System Design Guide," Section 4, "Duct Construction," and Section 5, "Ductwork System General."
2. Fabricate 90-degree mitered elbows to include turning vanes.

2.03 HANGERS AND SUPPORTS

A. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts.

B. Hanger Rods for Corrosive Environments: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.

C. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct."

D. Steel Cables: [**ASTM A 603, galvanized**] [**ASTM A 492, stainless**] steel with end connections made of cadmium-plated steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.

E. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.

F. Trapeze and Riser Supports: Steel shapes complying with ASTM A 36/A 36M.

PART 3 - EXECUTION

3.01 DUCT INSTALLATION

A. Install ducts with fewest possible joints.

B. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.

C. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.

D. Install ducts with a clearance of 1 inch, plus allowance for insulation thickness.

E. Where ducts pass through non-fire-rated interior partitions and exterior walls and are exposed to view, cover the opening between the partition and duct or duct insulation with sheet metal flanges. Overlap openings on four sides by at least 1-1/2 inches.

F. Where ducts pass through fire-rated interior partitions and exterior walls, install fire dampers. Comply with requirements in Section 233300 "Air Duct Accessories" for fire and smoke dampers.

G. Protect duct interiors from the moisture, construction debris and dust, and other foreign materials.[**Comply with SMACNA's "IAQ Guidelines for Occupied Buildings Under Construction," Appendix G, "Duct Cleanliness for New Construction Guidelines."**]

H. Install fibrous-glass ducts and fittings to comply with [**NAIMA AH116, "Fibrous Glass Duct Construction Standards**] [**SMACNA's "Fibrous Glass Duct Construction Standards**]."

I. Install foam ducts and fittings to comply with Knauf Insulation's "Knauf KoolDuct System Design Guide."

3.02 HANGER AND SUPPORT INSTALLATION

A. Install hangers and supports for fibrous-glass ducts and fittings to comply with [**SMACNA's "Fibrous Glass Duct Construction Standards," Chapter 6, "Hangers and Supports."**] [**NAIMA AH116, "Fibrous Glass Duct Construction Standards," Section VI, "Hangers and Supports."**]

B. Install hangers and supports for phenolic-foam ducts and fittings to comply with Knauf Insulation's "Knauf KoolDuct System Design Guide," Section 5, "Ductwork System General."

C. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.

1. Install concrete inserts before placing concrete.
2. Install powder-actuated concrete fasteners after concrete is placed and completely cured.
3. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches thick.
4. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches thick.

D. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

3.03 DUCT CLEANING

A. Clean [**new**] [**and**] [**existing**] duct system(s) before testing, adjusting, and balancing.

B. Use service openings for entry and inspection.

1. Create new openings and install access panels appropriate for duct static-pressure class if required for cleaning access. Provide insulated panels for insulated or lined duct. Patch duct as recommended by duct manufacturer. Comply with Section 233300 "Air Duct Accessories" for access panels and doors.
2. Disconnect and reconnect flexible ducts as needed for cleaning and inspection.
3. Remove and reinstall ceiling to gain access during the cleaning process.

C. Particulate Collection and Odor Control:

1. When venting vacuuming system inside the building, use HEPA filtration with 99.97 percent collection efficiency for 0.3-micron-size (or larger) particles.
2. When venting vacuuming system to outdoors, use filter to collect debris removed from HVAC system, and locate exhaust downwind and away from air intakes and other points of entry into building.

D. Clean the following components by removing surface contaminants and deposits:

1. Air outlets and inlets (registers, grilles, and diffusers).

2. Supply, return, and exhaust fans including fan housings, plenums (except ceiling supply and return plenums), scrolls, blades or vanes, shafts, baffles, dampers, and drive assemblies.
3. Air-handling unit internal surfaces and components including mixing box, coil section, air wash systems, spray eliminators, condensate drain pans, humidifiers and dehumidifiers, filters and filter sections, and condensate collectors and drains.
4. Coils and related components.
5. Return-air ducts, dampers, actuators, and turning vanes except in ceiling plenums and mechanical equipment rooms.
6. Supply-air ducts, dampers, actuators, and turning vanes.
7. Dedicated exhaust and ventilation components and makeup air systems.

E. Mechanical Cleaning Methodology:

1. Use vacuum-collection devices that are operated continuously during cleaning. Connect vacuum device to downstream end of duct sections so areas being cleaned are under negative pressure.
2. Use mechanical agitation to dislodge debris adhered to interior duct surfaces without damaging integrity of ducts or duct accessories.
3. Clean fibrous-glass duct with HEPA vacuuming equipment; do not permit duct to get wet. Replace fibrous-glass duct that is damaged, deteriorated, or delaminated or that has friable material, mold, or fungus growth.
4. Clean coils and coil drain pans according to NADCA 1992. Keep drain pan operational. Rinse coils with clean water to remove latent residues and cleaning materials; comb and straighten fins.
5. Provide drainage and cleanup for wash-down procedures.
6. Antimicrobial Agents and Coatings: Apply EPA-registered antimicrobial agents if fungus is present. Apply antimicrobial agents according to manufacturer's written instructions after removal of surface deposits and debris.

3.04 START UP

A. Air Balance: Comply with requirements in Section 230593 "Testing, Adjusting, and Balancing for HVAC."

3.05 DUCT SCHEDULE

A. Indoor Ducts and Fittings:

1. Fibrous-Glass Rectangular Ducts and Fittings:

   a. Minimum Flexural Rigidity: EI-**475**
   b. Minimum Board Thickness: **1 inch.**

2. Fibrous-Glass Round Ducts and Fittings:

   a. Minimum Thickness: **1 inch.**

3. Phenolic-Foam Rectangular Ducts and Fittings:

a. Minimum Panel Thickness: **7/8 inch.**
b. Aluminum Cladding: Minimum 0.025 inch (0.635 mm) thick.

B. Outdoor Duct and Fittings:

1. Phenolic-Foam Rectangular Ducts and Fittings:

a. Minimum Panel Thickness: **7/8 inch.**
b. Aluminum Cladding: Minimum 0.032 inch thick.
c. Polymeric Sealing System: Coat ducts, including gang-nail couplings, grip flanges, and couplings.

END OF SECTION 233116

SECTION 232300
REFRIGERANT PIPING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Refrigerant pipes and fittings.
2. Refrigerant piping valves and specialties.
3. Refrigerants.

1.02 SUBMITTALS

A. Refer to specification 230100 – General Requirements for HVAC.

1.03 QUALITY ASSURANCE

A. Comply with ASHRAE 15, "Safety Code for Refrigeration Systems."

B. Comply with ASME B31.5, "Refrigeration Piping and Heat Transfer Components."

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Line Test Pressure for Refrigerant R-410A:

1. Refer to manufacturer requirements for suction and liquid line pressures.

2.02 COPPER TUBE AND FITTINGS

A. Copper Tube: ACR

B. Wrought-Copper Fittings: ASME B16.22.

C. Wrought-Copper Unions: ASME B16.22.

D. Solder Filler Metals: ASTM B 32. Use 95-5 tin antimony or alloy HB solder to join copper socket fittings on copper pipe.

E. Brazing Filler Metals: AWS A5.8/A5.8M.

F. Flexible Connectors:

1. Body: Tin-bronze bellows with woven, flexible, tinned-bronze-wire-reinforced protective jacket.
2. End Connections: Socket ends.
3. Working Pressure Rating: Factory test at minimum 500 psig.
4. Maximum Operating Temperature: 250 deg F.

2.03 VALVES AND SPECIALTIES

A. General:

1. Verify operating and max temperature and pressures with equipment manufacturers. Refer to manufacturer's installation manual for connection dimensions and types.

B. Check Valves:

1. Body: Ductile iron, forged brass, or cast bronze; globe pattern.
2. Bonnet: Bolted ductile iron, forged brass, or cast bronze; or brass hex plug.
3. Piston: Removable polytetrafluoroethylene seat.
4. Closing Spring: Stainless steel.
5. Manual Opening Stem: Seal cap, plated-steel stem, and graphite seal.
6. End Connections: Socket, union, threaded, or flanged.

C. Service Valves:

1. Body: Forged brass with brass cap including key end to remove core.
2. Core: Removable ball-type check valve with stainless-steel spring.
3. Seat: Polytetrafluoroethylene.
4. End Connections: Copper spring.

D. Solenoid valves in "Solenoid Valves" Paragraph below are made normally closed or normally open. Normally closed are direct acting and pilot operated. Holding coils are available in several voltages.

E. Solenoid Valves: Comply with AHRI 760 and UL 429; listed and labeled by a National Recognized Testing Laboratory (NRTL).

1. Body and Bonnet: Plated steel.
2. Solenoid Tube, Plunger, Closing Spring, and Seat Orifice: Stainless steel.
3. Seat: Polytetrafluoroethylene.
4. End Connections: Threaded.
5. Electrical: Molded, watertight coil in NEMA 250 enclosure of type required by location.

F. Safety Relief Valves: Comply with 2010 ASME Boiler and Pressure Vessel Code; listed and labeled by an NRTL.

1. Body and Bonnet: Ductile iron and steel, with neoprene O-ring seal.
2. Piston, Closing Spring, and Seat Insert: Stainless steel.
3. Seat: Polytetrafluoroethylene.
4. End Connections: Threaded.

G. Thermostatic Expansion Valves: Comply with AHRI 750.

1. Body, Bonnet, and Seal Cap: Forged brass or steel.
2. Diaphragm, Piston, Closing Spring, and Seat Insert: Stainless steel.
3. Packing and Gaskets: Non-asbestos.
4. Capillary and Bulb: Copper tubing filled with refrigerant charge.
5. Suction Temperature: **40 deg F**
6. Superheat: **Adjustable**

H. Straight-Type Strainers:

1. Body: Welded steel with corrosion-resistant coating.
2. Screen: 100-mesh stainless steel.
3. End Connections: Socket or flare.

I. Angle-Type Strainers:

1. Body: Forged brass or cast bronze.
2. Drain Plug: Brass hex plug.
3. Screen: 100-mesh monel.
4. End Connections: Socket or flare.

J. Moisture/Liquid Indicators:

1. Body: Forged brass.
2. Window: Replaceable, clear, fused glass window with indicating element protected by filter screen.
3. Indicator: Color coded to show moisture content in parts per million (ppm).
4. Minimum Moisture Indicator Sensitivity: Indicate moisture above 60 ppm.
5. End Connections: Socket or flare.

K. Replaceable-Core Filter Dryers: Comply with AHRI 730.

1. Body and Cover: Painted-steel shell with ductile-iron cover, stainless-steel screws, and neoprene gaskets.
2. Filter Media: 10 micron, pleated with integral end rings; stainless-steel support.
3. Desiccant Media: Activated [**alumina**] [**charcoal**].
4. Designed for reverse flow (for heat-pump applications).
5. End Connections: Socket.

L. Permanent Filter Dryers: Comply with AHRI 730.

1. Body and Cover: Painted-steel shell.
2. Filter Media: 10 micron, pleated with integral end rings; stainless-steel support.
3. Desiccant Media: Activated [**alumina**] [**charcoal**].
4. Designed for reverse flow (for heat-pump applications).
5. End Connections: Socket.

2.04 REFRIGERANTS

A. ASHRAE 34, R-410A: Pentafluoroethane/Difluoromethane.

PART 3 - EXECUTION

3.01 PIPING APPLICATIONS FOR REFRIGERANT R-410A

A. Suction Lines: Copper, Type ACR, annealed-temper tubing and wrought-copper fittings with soldered joints.

B. Hot-Gas and Liquid Lines[**, and Suction Lines for Heat-Pump Applications**]: Copper, Type ACR, annealed-temper tubing and wrought-copper fittings with **soldered** joints.

C. Safety-Relief-Valve Discharge Piping: Copper, ACR drawn-temper tubing and wrought-copper fittings with soldered joints.

3.02 PIPING INSTALLATION

A. Install refrigerant piping according to ASHRAE 15.

B. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

E. Install piping adjacent to machines to allow service and maintenance.

F. Install piping free of sags and bends.

G. Install fittings for changes in direction and branch connections.

H. Select system components with pressure rating equal to or greater than system operating pressure.

I. Install piping as short and direct as possible, with a minimum number of joints, elbows, and fittings.

J. Arrange piping to allow inspection and service of refrigeration equipment. Install valves and specialties in accessible locations to allow for service and inspection. Install access doors or panels as specified in Section 083113 "Access Doors and Frames" if valves or equipment requiring maintenance is concealed behind finished surfaces.

K. Install refrigerant piping in rigid or flexible conduit in locations where exposed to mechanical injury.

L. Slope refrigerant piping as follows:

1. Install horizontal hot-gas discharge piping with a uniform slope downward away from compressor.

2. Install horizontal suction lines with a uniform slope downward to compressor.
3. Install traps and double risers to entrain oil in vertical runs.
4. Liquid lines may be installed level.

M. When brazing or soldering, remove solenoid-valve coils and sight glasses; also remove valve stems, seats, and packing, and accessible internal parts of refrigerant specialties. Do not apply heat near expansion-valve bulb.

N. Install piping with adequate clearance between pipe and adjacent walls and hangers or between pipes for insulation installation.

O. Identify refrigerant piping and valves according to Section 230553 "Identification for HVAC Piping and Equipment."

P. Install sleeves for piping penetrations of walls, ceilings, and floors.

Q. Install sleeve seals for piping penetrations of concrete walls and slabs.

R. Install escutcheons for piping penetrations of walls, ceilings, and floors.

3.03 PIPE JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs.

B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

C. Soldered Joints: Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook."

D. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," Chapter "Pipe and Tube."

1. Use Type BCuP (copper-phosphorus) alloy for joining copper socket fittings with copper pipe.
2. Use Type BAg (cadmium-free silver) alloy for joining copper with bronze or steel.

3.04 HANGERS AND SUPPORTS

A. Coordinate hanger type in field. Install at intervals that satisfy pipe and equipment manufacturer recommendations.

B. Support multi-floor vertical runs at least at each floor.

3.05 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Comply with ASME B31.5, Chapter VI.

2. Test refrigerant piping, specialties, and receivers. Isolate compressor, condenser, evaporator, and safety devices from test pressure if they are not rated above the test pressure.
3. Test high- and low-pressure side piping of each system separately at not less than the pressures indicated in "Performance Requirements" Article.

    a. Fill system with nitrogen to the required test pressure.
    b. System shall maintain test pressure at the manifold gage throughout duration of test.
    c. Test joints and fittings with electronic leak detector or by brushing a small amount of soap and glycerin solution over joints.
    d. Remake leaking joints using new materials, and retest until satisfactory results are achieved.

B. Prepare test and inspection reports.

3.06 SYSTEM CHARGING

A. Charge system using the following procedures:

1. Install core in filter dryers after leak test but before evacuation.
2. Evacuate entire refrigerant system with a vacuum pump. If vacuum holds for 12 hours, system is ready for charging.
3. Break vacuum with refrigerant gas, allowing pressure to build up.
4. Charge system with a new filter-dryer core in charging line.

3.07 ADJUSTING

A. Adjust thermostatic expansion valve to obtain proper evaporator superheat.

B. Adjust high- and low-pressure switch settings to avoid short cycling in response to fluctuating suction pressure.

C. Adjust set-point temperature of air-conditioning or chilled-water controllers to the system design temperature.

D. Perform the following adjustments before operating the refrigeration system, according to manufacturer's written instructions:

1. Open shutoff valves in condenser water circuit.
2. Verify that compressor oil level is correct.
3. Open compressor suction and discharge valves.
4. Open refrigerant valves except bypass valves that are used for other purposes.
5. Check open compressor-motor alignment and verify lubrication for motors and bearings.

E. Replace core of replaceable filter dryer after system has been adjusted and after design flow rates and pressures are established.

END OF SECTION 232300

SECTION 233300
AIR DUCT ACCESSORIES

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
1. Manual volume dampers.
2. Flexible connectors.
3. Flexible ducts.
4. Duct accessory hardware.

1.02 SUBMITTALS

A. Refer to specification 230100 – General Requirements for HVAC.

PART 2 - PRODUCTS

2.01 ASSEMBLY DESCRIPTION

A. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," and with NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."

B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

2.02 MANUAL VOLUME DAMPERS

A. Furnish and install opposed-blade, multi-leaf, leak-proof volume control dampers where indicated on drawings and locations in supply, return, and exhaust ducts where branches are taken from larger ducts and as required to achieve system air balance quantities. Balancing devices must be provided in accordance with OMC 603.17. All manual volume dampers must be shown on coordination drawings when submitted for review.

2.03 FLEXIBLE CONNECTORS

A. Materials: Flame-retardant or noncombustible fabrics.

B. Coatings and Adhesives: Comply with UL 181, Class 1.

C. Indoor System, Flexible Connector Fabric: Glass fabric double coated with neoprene.

D. Outdoor System, Flexible Connector Fabric: Glass fabric double coated with weatherproof, synthetic rubber resistant to UV rays and ozone.

2.04 FLEXIBLE DUCTS

A. Non-insulated, Flexible Duct: UL 181, Class 1, 2-ply vinyl film supported by helically wound, spring-steel wire.

B. Insulated, Flexible Duct: UL 181, Class 1, aluminum laminate and polyester film with latex adhesive supported by helically wound, spring-steel wire; fibrous-glass insulation; vapor-barrier film.
   1. Insulation R-value: Comply with ASHRAE/IESNA 90.1.

C. Flexible Duct Connectors:

   1. Clamps: Stainless-steel band with cadmium-plated hex screw to tighten band with a worm-gear action or Nylon strap in sizes 3 through 18 inches, to suit duct size.
   2. Non-Clamp Connectors: Adhesive, Liquid adhesive plus tape, or Adhesive plus sheet metal screws.

2.05 DUCT ACCESSORY HARDWARE

A. Instrument Test Holes: Cast iron or cast aluminum to suit duct material, including screw cap and gasket. Size to allow insertion of pitot tube and other testing instruments and of length to suit duct-insulation thickness.

B. Adhesives: High strength, quick setting, neoprene based, waterproof, and resistant to gasoline and grease.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install duct accessories according to applicable details in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for metal ducts.

B. Install duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel and fibrous-glass ducts, stainless-steel accessories in stainless-steel ducts, and aluminum accessories in aluminum ducts.

C. Install backdraft dampers at inlet of exhaust fans or exhaust ducts as close as possible to exhaust fan unless otherwise indicated.

D. Install volume dampers at points on supply, return, and exhaust systems where branches extend from larger ducts. Where dampers are installed in ducts having duct liner, install dampers with hat channels of same depth as liner, and terminate liner with nosing at hat channel.

E. Set dampers to fully open position before testing, adjusting, and balancing.

F. Install test holes at fan inlets and outlets and elsewhere as indicated.

G. Install flexible connectors to connect ducts to equipment.

H. Connect diffusers to supply ducts with maximum 8’ lengths of flexible duct clamped or strapped in place.

I. Install duct test holes where required for testing and balancing purposes.

3.02 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. Operate dampers to verify full range of movement.

END OF SECTION 233300

SECTION 233423
HVAC POWER VENTILATORS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Ceiling-mounted ventilators.
   2. Centrifugal roof ventilators.

1.02 SUBMITTALS

A. Refer to specification 230100 – General Requirements for HVAC.

1.03 QUALITY ASSURANCE

A. Air and sound ratings shall be certified by HVI.

PART 2 - PRODUCTS

2.01 CEILING-MOUNTED VENTILATORS

A. Manufacturer: Exhaust fan manufacturers shall be equal to the following:
   1. Broan
   2. Greenheck
   3. Loren Cook Company
   4. Panasonic

B. Housing: 26-gage galvanized steel construction with adjustable mounting brackets.

C. Fan Wheel: Centrifugal blower wheel. Motor shall be permanently lubricated.

D. Grille: Painted steel, louvered grille with flange on intake and thumbscrew attachment to fan housing.

E. Electrical Requirements: Junction box for electrical connection on housing and receptacle for motor plug-in.

F. Controls: Fan to run intermittently with a fan switch in the bathroom and a reverse acting thermostat in the Server room.

G. Accessories:
   1. Backdraft damper in duct connection of fan.

H. Capacities and Characteristics: Refer to schedule on drawing.

2.02 CENTRIFUGAL ROOF VENTILATORS

A. Manufacturer: Exhaust fan manufacturers shall be equal to the following:
   1. Carnes
   2. Greenheck
   3. Loren Cook Company

B. Housing: Removable, galvanized steel, mushroom-domed top; square, one-piece, aluminum base with venturi inlet cone.

C. Fan Wheels: Aluminum hub and wheel with backward-inclined blades.

D. Accessories:
   1. Motorized Dampers: Parallel-blade dampers mounted in curb base with electric actuator; wired to close when fan stops.

E. Roof Curbs: Galvanized steel; mitered and welded corners; 1-1/2-inch- thick, rigid, fiberglass insulation adhered to inside walls; and 1-1/2-inch wood nailer. Size as required to suit roof opening and fan base.

F. Capacities and Characteristics: Refer to schedule on drawing.

2.03 MOTORS

A. Enclosure Type: Totally enclosed motor with long life bearings designed for continuous operation.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install units with clearances for service and maintenance. Install per manufacturer’s requirements.

END OF SECTION 233423

SECTION 233713
DIFFUSERS, REGISTERS, AND GRILLES

PART 1 - GENERAL

1.01 SUMMARY

1.02 SUBMITTALS

A. Refer to specification 230100 – General Conditions of HVAC.

PART 2 - PRODUCTS

2.01 CEILING DIFFUSERS, REGISTERS, AND GRILLES

A. Manufacturer: Air devices shall be equal to the following:
1. Price
2. Titus
3. Krueger
4. Greenheck

B. Manufacturer: Louvers shall be equal to the following:
1. Ruskin
2. Greenheck
3. Nailor

C. Refer to air device schedule on drawings for details.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install diffusers, registers, grilles, and louvers level and plumb. Install per manufacturer's requirements.

B. Ceiling-Mounted Outlets and Inlets: Drawings indicate general arrangement of ducts, fittings, and accessories. Air outlet and inlet locations have been indicated to achieve design requirements for air volume, noise criteria, airflow pattern, throw, and pressure drop. Make final locations where indicated, as much as practical.

C. Install diffusers, registers, and grilles with airtight connections to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.

D. Provide all miscellaneous items necessary for a complete and proper installation in the type of ceiling and walls used in this project.

3.02 ADJUSTING

A. After installation, adjust registers, and grilles to air patterns indicated, or as directed, before starting air balancing.

END OF SECTION 233713

SECTION 235416.13
GAS-FIRED FURNACES

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Gas-fired, condensing furnaces and accessories complete with controls.
2. Air filters.
3. Humidifiers.

1.02 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. LEED Submittals:

1. Product Data for Credit EA 4: Documentation indicating that equipment and refrigerants comply.
2. Product Data for Prerequisite IEQ 1: Documentation indicating that units comply with ASHRAE 62.1, Section 5 - "Systems and Equipment."
3. Product Data for Credit IEQ 4.1: For solvent cements and adhesive primers, documentation including printed statement of VOC content.
4. Laboratory Test Reports for Credit IEQ 4: For solvent cements and adhesive primers, documentation indicating that products comply with the testing and product requirements of the California Department of Public Health's (formerly, the California Department of Health Services') "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

C. Shop Drawings:

1. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
2. Include diagrams for power, signal, and control wiring.

1.03 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace the following components of furnaces that fail in materials or workmanship within specified warranty period.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. CARRIER

B. TEMPSTER

C. TRANE

D. MAGICPAK

2.02 ASSEMBLY DESCRIPTION

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a qualified testing agency, and marked for intended location and application.

B. General Requirements for Noncondensing Gas-Fired Furnaces: Factory assembled, piped, wired, and tested; complying with ANSI Z21.47/CSA 2.3 and NFPA 54.

2.03 GAS-FIRED FURNACES, CONDENSING

A. Cabinet: Steel.

1. Cabinet interior around heat exchanger shall be factory-installed insulation.
2. Lift-out panels shall expose burners and all other items requiring access for maintenance.
3. Factory paint external cabinets in manufacturer's standard color.
4. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

B. Fan: Centrifugal, factory balanced, resilient mounted, direct drive.

1. Fan Motors: Comply with requirements in Section 230513 "Common Motor Requirements for HVAC Equipment."
2. Special Motor Features: Single speed, premium efficiency, as defined in Section 230513 "Common Motor Requirements for HVAC Equipment," and with internal thermal protection and permanent lubrication.
3. Special Motor Features: Multi-tapped, multispeed with internal thermal protection and permanent lubrication.
4. Special Motor Features: Electronically controlled motor (ECM) controlled by integrated furnace/blower control.

C. Type of Gas: Natural.

D. Heat Exchanger:

1. Primary: Aluminized steel.

2. Secondary: **Stainless** steel.

E. Burner:

1. Gas Valve: 100 percent safety **two-stage** main gas valve, main shutoff valve, pressure regulator, safety pilot with electronic flame sensor, limit control, transformer, and combination ignition/fan timer control board.
2. Ignition: Electric pilot ignition, with hot-surface igniter or electric spark ignition.

F. Gas-Burner Safety Controls:

1. Electronic Flame Sensor: Prevents gas valve from opening until pilot flame is proven; stops gas flow on ignition failure.
2. Flame Rollout Switch: Installed on burner box; prevents burner operation.
3. Limit Control: Fixed stop at maximum permissible setting; de-energizes burner on excessive bonnet temperature; automatic reset.

G. Combustion-Air Inducer: Centrifugal fan with thermally protected motor and sleeve bearings pre-purges heat exchanger and vents combustion products; pressure switch prevents furnace operation if combustion-air inlet or flue outlet is blocked.

H. Furnace Controls: Solid-state board integrates ignition, heat, cooling, and fan speeds; adjustable fan-on and fan-off timing; terminals for connection to accessories [diagnostic light with viewport].

I. Accessories:

1. Combination Combustion-Air Intake and Vent: PVC plastic fitting to combine combustion-air inlet and vent through outside wall.
2. CPVC Plastic Vent Materials:

a. CPVC Plastic Pipe: Schedule 40, complying with ASTM F 441/F 441M.
b. CPVC Plastic Fittings: Schedule 40, complying with ASTM F 438, socket type.
c. CPVC Solvent Cement: ASTM F 493.

1) CPVC solvent cement shall have a VOC content of 490 g/L or less.
2) Adhesive primer shall have a VOC content of 550 g/L or less.
3) Solvent cement and adhesive primer shall comply with the testing and product requirements of the California Department of Public Health's (formerly, the California Department of Health Services') "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

3. PVC Plastic Vent Materials:

a. PVC Plastic Pipe: Schedule 40, complying with ASTM D 1785.

2.04 GAS-FIRED VTAC, CONDENSING

A. Cabinet: Steel.

1. Cabinet interior around heat exchanger shall be factory-installed insulation.
2. Lift-out panels shall expose burners and all other items requiring access for maintenance.
3. Factory paint external cabinets in manufacturer's standard color.
4. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

B. Fan: Centrifugal, factory balanced, resilient mounted, direct drive.

1. Fan Motors: Comply with requirements in Section 230513 "Common Motor Requirements for HVAC Equipment."
2. Special Motor Features: Single speed, premium efficiency, as defined in Section 230513 "Common Motor Requirements for HVAC Equipment," and with internal thermal protection and permanent lubrication.
3. Special Motor Features: Multi-tapped, multispeed with internal thermal protection and permanent lubrication.
4. Special Motor Features: Electronically controlled motor (ECM) controlled by integrated furnace/blower control.

C. Type of Gas: Natural.

D. Heat Exchanger:

1. Primary: Aluminized steel.
2. Secondary: Stainless steel.

E. Burner:

1. Gas Valve: 100 percent safety two-stage main gas valve, main shutoff valve, pressure regulator, safety pilot with electronic flame sensor, limit control, transformer, and combination ignition/fan timer control board.
2. Ignition: Electric pilot ignition, with hot-surface igniter or electric spark ignition.

F. Gas-Burner Safety Controls:

1. Electronic Flame Sensor: Prevents gas valve from opening until pilot flame is proven; stops gas flow on ignition failure.
2. Flame Rollout Switch: Installed on burner box; prevents burner operation.
3. Limit Control: Fixed stop at maximum permissible setting; de-energizes burner on excessive bonnet temperature; automatic reset.

G. Combustion-Air Inducer: Centrifugal fan with thermally protected motor and sleeve bearings pre-purges heat exchanger and vents combustion products; pressure switch prevents furnace operation if combustion-air inlet or flue outlet is blocked.

H. Furnace Controls: Solid-state board integrates ignition, heat, cooling, and fan speeds; adjustable fan-on and fan-off timing; terminals for connection to accessories [diagnostic light with viewport].

I. Accessories:

1. Combination Combustion-Air Intake and Vent: PVC plastic fitting to combine combustion-air inlet and vent through outside wall.

2. PVC Plastic Vent Materials:

   a. PVC Plastic Pipe: Schedule 40, complying with ASTM D 1785.

2.05 THERMOSTATS

A. Controls shall comply with requirements in ASHRAE/IES 90.1, "Controls."

B. Solid-State Thermostat: Wall-mounted programmable, microprocessor-based unit with automatic switching from heating to cooling, preferential rate control, seven-day programmability with minimum of four temperature presets per day, [vacation mode] and battery backup protection against power failure for program settings.

C. Single-Stage, Heating-Cooling Thermostat: Adjustable, heating-cooling, wall-mounted unit with fan on-automatic selector.

D. Two-Stage, Heating-Cooling Thermostat: Adjustable, heating-cooling, wall-mounted unit with fan on-automatic selector.

E. Control Wiring: Unshielded twisted-pair cabling.

1. No. 24 AWG, 100 ohm, four pair.
2. Cable Jacket Color: Blue

2.06 AIR FILTERS

A. Disposable Filters: 1-inch merv 8 thick fiberglass media in sheet metal frame.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install gas-fired furnaces and associated fuel and vent features and systems according to NFPA 54.

B. Suspended Units: Suspend from structure using threaded rods, spring hangers, and building attachments. Secure rods to unit hanger attachments. Adjust hangers so unit is level and plumb.

C. Base-Mounted Units: Secure units to substrate. Provide optional bottom closure base if required by installation conditions.

D. Wiring Method: Install control wiring in accessible ceiling spaces and in gypsum board partitions where unenclosed wiring method may be used. Conceal control wiring except in unfinished spaces.

3.02 CONNECTIONS

A. Gas piping installation requirements are specified in Section 231123 "Facility Natural-Gas Piping." indicate general arrangement of piping, fittings, and specialties. Connect gas piping with union or flange and appliance connector valve.

B. Install piping adjacent to equipment to allow service and maintenance.

C. Water piping installation requirements are specified in Section 221116 "Domestic Water Piping." Drawings indicate general arrangement of piping, fittings, and specialties. Connect water piping with union and ball valve.

D. Vent Connection, Noncondensing, Gas-Fired Furnaces: Connect Type B vents to furnace vent connection and extend outdoors. Type B vents and their installation requirements are specified in Section 235100 "Breechings, Chimneys, and Stacks."

E. Vent and Outside-Air Connection, Condensing, Gas-Fired Furnaces: Connect plastic piping vent material to furnace connections and extend outdoors. Terminate vent outdoors with a cap and in an arrangement that will protect against entry of birds, insects, and dirt.

F. Connect ducts to furnace with flexible connector. Comply with requirements in Section 233300 "Air Duct Accessories."

3.03 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Perform electrical test and visual and mechanical inspection.
2. Leak Test: After installation, charge systems with refrigerant and test for leaks. Repair leaks, replace lost refrigerant, and retest until no leaks exist.
3. Operational Test: After electrical circuitry has been energized, start units to confirm proper operation, product capability, and compliance with requirements.
4. Verify that fan wheel is rotating in the correct direction and is not vibrating or binding.
5. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

B. Verify that vibration isolation and flexible connections properly dampen vibration transmission to structure.

END OF SECTION 235416.13

SECTION 238239.19
ELECTRIC UNIT HEATERS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
1. Wall heaters.

1.02 SUBMITTALS

A. Refer to specification 230100 – General Conditions of HVAC.

PART 2 - PRODUCTS

2.01 WALL HEATERS

A. Manufacturer: Heaters shall be equal to the following:
1. Berko
2. Markel
3. Marley

B. Description
1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Casing
1. Frame: Heavy gauge steel.
2. Finish: Phosphatized and painted with a powder coating enamel.

D. Coil
1. Electric-Resistance Heating Coil: Nickel-chromium heating wire, free from expansion noise and 60-Hz hum, embedded in magnesium oxide refractory and sealed in corrosion-resistant metallic sheath. Terminate elements in stainless-steel, machine-staked terminals secured with stainless-steel hardware, and limit controls for high-temperature protection.

E. Fan and Motor
1. Fan: Aluminum propeller directly connected to motor.
2. Motor: Permanently lubricated.

F. Controls
1. Built-in thermostat.
2. Built-in fan relay.
3. Built-in thermal cutout.
4. Electrical Connection: Factory wire motors and controls for a single field connection.

G. Accessories (refer to schedule on drawing for any additional accessories)
1. Double-pole, single throw disconnect switch.

2. Front cover.

H. Capacities and Characteristics: Refer to schedule on drawing.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install wall and ceiling unit heaters to comply with NFPA 90A.

B. Install heaters level and plumb.

C. Install wall-mounted thermostats and switch controls in electrical outlet boxes at heights to match lighting controls. Verify location of thermostats and other exposed control sensors with Drawings and room details before installation.

END OF SECTION 238239.19

SECTION 260519

LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Building wires and cables rated 600 V and less.
2. Connectors, splices, and terminations rated 600 V and less.

B. Related Requirements:

1. Section 260523 "Control-Voltage Electrical Power Cables" for control systems communications cables and Classes 1, 2 and 3 control cables.
2. Section 271500 "Communications Horizontal Cabling" for cabling used for voice and data circuits.

PART 2 - PRODUCTS

2.1 CONDUCTORS AND CABLES

A. Aluminum and Copper Conductors: Comply with NEMA WC 70/ICEA S-95-658.

B. Conductor Insulation: Comply with NEMA WC 70/ICEA S-95-658 for Type THW-2, Type THHN-2-THWN-2, Type XHHW-2 Type UF, Type USE, and Type SO.

C. Multiconductor Cable: Comply with NEMA WC 70/ICEA S-95-658 for armored cable, Type AC metal-clad cable, Type MC nonmetallic-sheathed cable, Type NM, Type SO, and Type USE with ground wire.

2.2 CONNECTORS AND SPLICES

A. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

2.3 SYSTEM DESCRIPTION

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. Comply with NFPA 70.

PART 3 - EXECUTION

3.1 CONDUCTOR MATERIAL APPLICATIONS

A. Feeders: Copper for feeders smaller than No. 2 AWG; copper or aluminum for feeders No. 1 AWG and larger. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

B. Branch Circuits: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger, except VFC cable, which shall be extra flexible stranded.

3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

A. Service Entrance: Type XHHW-2, single conductors in raceway

B. Exposed Feeders: Type XHHW-2, single conductors in raceway

C. Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspaces: Type THHN-2-THWN-2, single conductors in raceway, Armored cable, Type AC, Metal-clad cable, Type MC, Nonmetallic-sheathed cable, Type NM.

D. Feeders Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN-2-THWN-2, single conductors in raceway, Type XHHW-2, single conductors in raceway.

E. Feeders Installed below Raised Flooring: Type THHN-2-THWN-2, single conductors in raceway, Armored cable, Type AC, Metal-clad cable, Type MC.

F. Exposed Branch Circuits, Including in Crawlspaces: Type THHN-2-THWN-2, single conductors in raceway.

G. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN-2-THWN-2, single conductors in raceway, Armored cable, Type AC, Metal-clad cable, Type MC, Nonmetallic-sheathed cable, Type NM.

H. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN-2-THWN-2, single conductors in raceway, Type XHHW-2, single conductors in raceway.

I. Branch Circuits Installed below Raised Flooring: Type THHN-2-THWN-2, single conductors in raceway, Armored cable, Type AC, Metal-clad cable, Type MC.

J. Cord Drops and Portable Appliance Connections: Type SO, hard service cord with stainless-steel, wire-mesh, strain relief device at terminations to suit application.

3.3 INSTALLATION OF CONDUCTORS AND CABLES

A. Conceal cables in finished walls, ceilings, and floors unless otherwise indicated.

B. Complete raceway installation between conductor and cable termination points according to Section 260533 "Raceways and Boxes for Electrical Systems" prior to pulling conductors and cables.

C. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.

D. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.

E. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.

F. Support cables according to Section 260529 "Hangers and Supports for Electrical Systems."

3.4 CONNECTIONS

A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B.

B. Make splices, terminations, and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than un spliced conductors.

1. Use oxide inhibitor in each splice, termination, and tap for aluminum conductors.

C. Wiring at Outlets: Install conductor at each outlet, with at least 8 inches (150 mm) of slack.

3.5 IDENTIFICATION

A. Identify and color-code conductors and cables according to Section 260553 "Identification for Electrical Systems."

B. Identify each spare conductor at each end with identity number and location of other end of conductor and identify as spare conductor.

3.6 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 260544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

3.7 FIRESTOPPING

A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly according to Section 078413 "Penetration Firestopping."

3.8 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. After installing conductors and cables and before electrical circuitry has been energized, test service entrance and feeder conductors for compliance with requirements.

2. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.

END OF SECTION 260519

SECTION 260526

GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Grounding systems and equipment.

1.2 QUALITY ASSURANCE

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. Comply with UL 467 for grounding and bonding materials and equipment.

PART 2 - PRODUCTS

2.1 CONDUCTORS

A. Insulated Conductors: Aluminum, copper or tinned-copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.

B. Bare Conductors:

1. Copper, Aluminum, or copper-clad aluminum. Copper only where in direct contact (or within 18” of contact), with masonry or the earth, or where subject to corrosive conditions.
2. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch (6 mm) in diameter.
3. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
4. Bonding Jumper: Copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches (41 mm) wide and 1/16 inch (1.6 mm) thick.
5. Tinned Bonding Jumper: Tinned-copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches (41 mm) wide and 1/16 inch (1.6 mm) thick.

2.2 CONNECTORS

A. Listed and labeled by an NRTL acceptable to authorities having jurisdiction for applications in which used and for specific types, sizes, and combinations of conductors and other items connected.

B. Bolted Connectors for Conductors and Pipes: Copper or copper alloy, pressure type with at least two bolts.

1. Pipe Connectors: Clamp type, sized for pipe.

C. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

2.3 GROUNDING ELECTRODES

A. Ground Rods: Copper-clad steel; 3/4 inch by 10 feet (19 mm by 3 m) in diameter.

PART 3 - EXECUTION

3.1 APPLICATIONS

A. Conductors: Install solid conductor for No. 8 AWG and smaller, and stranded conductors for No. 6 AWG and larger unless otherwise indicated.

B. Underground Grounding Conductors: Install bare tinned-copper conductor, No. 2/0 AWG minimum. Bury at least 24 inches (600 mm) below grade.

C. Isolated Grounding Conductors: Green-colored insulation with continuous yellow stripe. On feeders with isolated ground, identify grounding conductor where visible to normal inspection, with alternating bands of green and yellow tape, with at least three bands of green and two bands of yellow.

D. Conductor Terminations and Connections:

1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
2. Underground Connections: Welded connectors except at test wells and as otherwise indicated.
3. Connections to Ground Rods at Test Wells: Bolted connectors.
4. Connections to Structural Steel: Welded connectors.

3.2 EQUIPMENT GROUNDING

A. Install insulated equipment grounding conductors with the following items, in addition to those required by NFPA 70:

1. Feeders and branch circuits.
2. Lighting circuits.
3. Receptacle circuits.
4. Single-phase motor and appliance branch circuits.
5. Three-phase motor and appliance branch circuits.
6. Flexible raceway runs.
7. Armored and metal-clad cable runs.

8. [Busway Supply Circuits: Install insulated equipment grounding conductor from grounding bus in the switchgear, switchboard, or distribution panel to equipment grounding bar terminal on busway.]
9. Computer and Rack-Mounted Electronic Equipment Circuits: Install insulated equipment grounding conductor in branch-circuit runs from equipment-area power panels and power-distribution units.

B. Signal and Communication Equipment: In addition to grounding and bonding required by NFPA 70, provide a separate grounding system complying with requirements in TIA/ATIS J-STD-607-A.

1. For telephone, alarm, voice and data, and other communication equipment, provide No. 4 AWG minimum insulated grounding conductor in raceway from grounding electrode system to each service location, terminal cabinet, wiring closet, and central equipment location.
2. Service and Central Equipment Locations and Wiring Closets: Terminate grounding conductor on a 1/4-by-4-by-12-inch (6.3-by-100-by-300-mm) grounding bus.
3. Terminal Cabinets: Terminate grounding conductor on cabinet grounding terminal.

C. Metal Poles Supporting Outdoor Lighting Fixtures: Install grounding electrode and a separate insulated equipment grounding conductor in addition to grounding conductor installed with branch-circuit conductors.

3.3 INSTALLATION

A. Grounding Conductors: Route along shortest and straightest paths possible unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.

B. Ground Rods: Drive rods until tops are 2 inches (50 mm) below finished floor or final grade unless otherwise indicated.

1. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating if any.
2. For grounding electrode system, install at least three rods spaced at least one-rod length from each other and located at least the same distance from other grounding electrodes, and connect to the service grounding electrode conductor.

C. Test Wells: Ground rod driven through drilled hole in bottom of handhole. Handholes are specified in Section 260543 "Underground Ducts and Raceways for Electrical Systems," and shall be at least 12 inches (300 mm) deep, with cover.

1. Test Wells: Install at least one test well for each service unless otherwise indicated. Install at the ground rod electrically closest to service entrance. Set top of test well flush with finished grade or floor.

D. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance except where routed through short lengths of conduit.

1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install bonding so vibration is not transmitted to rigidly mounted equipment.
3. Use exothermic-welded connectors for outdoor locations; if a disconnect-type connection is required, use a bolted clamp.

E. Grounding and Bonding for Piping:

1. Metal Water Service Pipe: Install insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes; use a bolted clamp connector or bolt a lug-type connector to a pipe flange using one of the lug bolts of the flange. Where a dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.
2. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with a bolted connector.
3. Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.

3.4 LABELING

A. Comply with requirements in Section 260553 "Identification for Electrical Systems" for instruction signs. The label or its text shall be green.

B. Install labels at the telecommunications bonding conductor and grounding equalizer.

1. Label Text: "If this connector or cable is loose or if it must be removed for any reason, notify the facility manager."

3.5 FIELD QUALITY CONTROL

A. Perform the following tests and inspections and prepare test reports:

1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
2. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.
3. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal, and at ground test wells. Make tests at ground rods before any conductors are connected.

B. Report measured ground resistances that exceed the following values:

1. Power and Lighting Equipment or System with Capacity of 500 kVA and Less: 10 ohms.
2. Power and Lighting Equipment or System with Capacity of 500 to 1000 kVA: 5 ohms.
3. Power and Lighting Equipment or System with Capacity More Than 1000 kVA: 3 ohms.
4. Power Distribution Units or Panelboards Serving Electronic Equipment: 3 ohm(s).

C. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and include recommendations to reduce ground resistance.

END OF SECTION 260526

SECTION 260529

HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:

1. Hangers and supports for electrical equipment and systems.
2. Construction requirements for concrete bases.

1.2 PERFORMANCE REQUIREMENTS

A. Design supports for multiple raceways capable of supporting combined weight of supported systems and its contents.]

B. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

1.3 QUALITY ASSURANCE

A. [Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

A. Steel Slotted Support Systems: Comply with MFMA-4, factory-fabricated components for field assembly.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Allied Tube & Conduit.
b. Cooper B-Line, Inc.; a division of Cooper Industries.
c. ERICO International Corporation.
d. GS Metals Corp.
e. Thomas & Betts Corporation.
f. Unistrut; Tyco International, Ltd.
g. Wesanco, Inc.

2. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
3. Nonmetallic Coatings: Manufacturer's standard PVC, polyurethane, or polyester coating applied according to MFMA-4.
4. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4.
5. Channel Dimensions: Selected for applicable load criteria.

B. Raceway and Cable Supports: As described in NECA 1 and NECA 101.

C. Conduit and Cable Support Devices: **Steel** hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.

D. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for non-armored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be malleable iron.

E. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

F. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:

1. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.
   a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

      1) Hilti Inc.
      2) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
      3) MKT Fastening, LLC.
      4) Simpson Strong-Tie Co., Inc.; Masterset Fastening Systems Unit.

2. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated or stainless steel, for use in hardened portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials in which used.
   a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

      1) Cooper B-Line, Inc.; a division of Cooper Industries.
      2) Empire Tool and Manufacturing Co., Inc.
      3) Hilti Inc.
      4) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
      5) MKT Fastening, LLC.

3. Concrete Inserts: Steel or malleable-iron, slotted support system units similar to MSS Type 18; complying with MFMA-4 or MSS SP-58.

4. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.
5. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
6. Toggle Bolts: All-steel springhead type.
7. Hanger Rods: Threaded steel.

2.2 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

A. Description: Welded or bolted, structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.

B. Materials: Comply with requirements in Section 055000 "Metal Fabrications" for steel shapes and plates.

PART 3 - EXECUTION

3.1 APPLICATION

A. Comply with NECA 1 and NECA 101 for application of hangers and supports for electrical equipment and systems except if requirements in this Section are stricter.

B. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMT, IMC, and RMC as required by NFPA 70. Minimum rod size shall be 1/4 inch (6 mm) in diameter.

C. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.

1. Secure raceways and cables to these supports with two-bolt conduit clamps.

D. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2-inch (38-mm) and smaller raceways serving branch circuits and communication systems above suspended ceilings and for fastening raceways to trapeze supports where additional seismic design requirements do not apply. Refer to Section 260548 Vibration and Seismic Controls for Electrical Systems.

3.2 SUPPORT INSTALLATION

A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this Article.

B. Raceway Support Methods: In addition to methods described in NECA 1, EMT, IMC, RMC, EMT, IMC, and RMC may be supported by openings through structure members, as permitted in NFPA 70 Where additional seismic requirements do not apply. Refer to Section 260548 Vibration and Seismic Controls for Electrical Systems.

C. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb (90 kg).

D. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:

1. To Wood: Fasten with lag screws or through bolts.
2. To New Concrete: Bolt to concrete inserts.
3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
4. To Existing Concrete: Expansion anchor fasteners.
5. Instead of expansion anchors, powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete 4 inches (100 mm) thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inches (100 mm) thick.
6. To Steel: Welded threaded studs complying with AWS D1.1/D1.1M, with lock washers and nuts, Beam clamps (MSS Type 19, 21, 23, 25, or 27) complying with MSS SP-69, or Spring-tension clamps.
7. To Light Steel: Sheet metal screws.
8. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate by means that meet seismic-restraint strength and anchorage requirements.

E. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.

3.3 INSTALLATION OF FABRICATED METAL SUPPORTS

A. Comply with installation requirements in Section 055000 "Metal Fabrications" for site-fabricated metal supports.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.

C. Field Welding: Comply with AWS D1.1/D1.1M.

3.4 CONCRETE BASES

A. Construct concrete bases of dimensions indicated but not less than 4 inches (100 mm) larger in both directions than supported unit, and so anchors will be a minimum of 10 bolt diameters from edge of the base. Minimum base thickness is 3-1/2”

B. Use 3000-psi (20.7-MPa), 28-day compressive-strength concrete. Concrete materials, reinforcement, and placement requirements are specified in Section 033000 "Cast-in-Place Concrete, and Section 033053 "Miscellaneous Cast-in-Place Concrete."

C. Anchor equipment to concrete base.

1. Place and secure anchorage devices. Use supported equipment manufacturer's 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.
3. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

3.5 PAINTING

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils (0.05 mm).

B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION 260529

SECTION 260533

RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Metal conduits, tubing, and fittings.
2. Nonmetal conduits, tubing, and fittings.
3. Metal wireways and auxiliary gutters.
4. Nonmetal wireways and auxiliary gutters.
5. Surface raceways.
6. Boxes, enclosures, and cabinets.
7. Handholes and boxes for exterior underground cabling.

B. Related Requirements:
1. Section 270528 "Pathways for Communications Systems" for conduits, wireways, surface pathways, innerduct, boxes, faceplate adapters, enclosures, cabinets, and handholes serving communications systems.
2. Section 280528 "Pathways for Electronic Safety and Security" for conduits, surface pathways, innerduct, boxes, and faceplate adapters serving electronic safety and security.

1.2 ACTION SUBMITTALS

A. LEED Submittals:

1. Product Data for Credit IEQ 4.1: For solvent cements and adhesive primers, documentation including printed statement of VOC content.]
2. Laboratory Test Reports for Credit IEQ 4: For solvent cements and adhesive primers, documentation indicating that products comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

1.3 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Conduit routing plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of items involved:

1. Structural members in paths of conduit groups with common supports.

2. HVAC and plumbing items and architectural features in paths of conduit groups with common supports.

PART 2 - PRODUCTS

2.1 METAL CONDUITS, TUBING, AND FITTINGS

A. Listing and Labeling: Metal conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. GRC: Comply with ANSI C80.1 and UL 6.

C. ARC: Comply with ANSI C80.5 and UL 6A.

D. IMC: Comply with ANSI C80.6 and UL 1242.

E. PVC-Coated Steel Conduit: PVC-coated rigid steel conduit.

1. Comply with NEMA RN 1.
2. Coating Thickness: 0.040 inch (1 mm), minimum.

F. EMT: Comply with ANSI C80.3 and UL 797.

G. FMC: Comply with UL 1; zinc-coated steel or aluminum.

H. LFMC: Flexible steel conduit with PVC jacket and complying with UL 360.

I. Fittings for Metal Conduit: Comply with NEMA FB 1 and UL 514B.

1. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 886 and NFPA 70.
2. Fittings for EMT:

a. Material: Steel or die cast.
b. Type: Setscrew or compression.

3. Expansion Fittings: PVC or steel to match conduit type, complying with UL 651, rated for environmental conditions where installed, and including flexible external bonding jumper.
4. Coating for Fittings for PVC-Coated Conduit: Minimum thickness of 0.040 inch (1 mm), with overlapping sleeves protecting threaded joints.

J. Joint Compound for IMC, GRC, or ARC: Approved, as defined in NFPA 70, by authorities having jurisdiction for use in conduit assemblies, and compounded for use to lubricate and protect threaded conduit joints from corrosion and to enhance their conductivity.

2.2 NONMETALLIC CONDUITS, TUBING, AND FITTINGS

A. Listing and Labeling: Nonmetallic conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. ENT: Comply with NEMA TC 13 and UL 1653.

C. RNC: Type EPC-40-PVC, complying with NEMA TC 2 and UL 651 unless otherwise indicated.

D. LFNC: Comply with UL 1660.

E. Continuous HDPE: Comply with UL 651B.

F. Coilable HDPE: Preassembled with conductors or cables, and complying with ASTM D 3485.

G. Fittings for ENT and RNC: Comply with NEMA TC 3; match to conduit or tubing type and material.

H. Fittings for LFNC: Comply with UL 514B.

I. Solvent cements and adhesive primers shall have a VOC content of 510 and 550 g/L or less, respectively, when calculated according to 40 CFR 59, Subpart D (EPA Method 24).]

J. Solvent cements and adhesive primers shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.3 METAL WIREWAYS AND AUXILIARY GUTTERS

A. Description: Sheet metal, complying with UL 870 and NEMA 250, [Type 1, Type 3R, & Type 4] unless otherwise indicated, and sized according to NFPA 70.

1. Metal wireways installed outdoors shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Fittings and Accessories: Include covers, couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.

2.4 NONMETALLIC WIREWAYS AND AUXILIARY GUTTERS

A. Listing and Labeling: Nonmetallic wireways and auxiliary gutters shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Description: PVC, extruded and fabricated to required size and shape, and having snap-on cover, mechanically coupled connections, and plastic fasteners.

C. Fittings and Accessories: Couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings shall match and mate with wireways as required for complete system.

D. Solvent cements and adhesive primers shall have a VOC content of 510 and 550 g/L or less, respectively, when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

E. Solvent cements and adhesive primers shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.5 SURFACE RACEWAYS

A. Listing and Labeling: Surface raceways and tele-power poles shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Surface Metal Raceways: Galvanized steel with snap-on covers complying with UL 5.

C. Surface Nonmetallic Raceways: Two- or three-piece construction, complying with UL 5A, and manufactured of rigid PVC. Product shall comply with UL 94 V-0 requirements for self-extinguishing characteristics.

D. Tele-Power Poles:

1. Material: [Galvanized steel with ivory baked-enamel finish] [Aluminum with clear anodized finish].
2. Fittings and Accessories: Dividers, end caps, covers, cutouts, wiring harnesses, devices, mounting materials, and other fittings shall match and mate with tele-power pole as required for complete system.]

2.6 BOXES, ENCLOSURES, AND CABINETS

A. General Requirements for Boxes, Enclosures, and Cabinets: Boxes, enclosures, and cabinets installed in wet locations shall be listed for use in wet locations.

B. Sheet Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.

C. Cast-Metal Outlet and Device Boxes: Comply with NEMA FB 1, ferrous alloy Type FD, with gasketed cover.

D. Nonmetallic Outlet and Device Boxes: Comply with NEMA OS 2 and UL 514C.

E. Metal Floor Boxes:

1. Material: Cast metal or sheet metal.
2. Type: Fully adjustable Semi-adjustable.
3. Shape: Rectangular.
4. Listing and Labeling: Metal floor boxes shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

F. Nonmetallic Floor Boxes: Nonadjustable, round or rectangular.

1. Listing and Labeling: Nonmetallic floor boxes shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

G. Luminaire Outlet Boxes: Nonadjustable, designed for attachment of luminaire weighing 50 lb (23 kg). Outlet boxes designed for attachment of luminaires weighing more than 50 lb (23 kg) shall be listed and marked for the maximum allowable weight.

H. Paddle Fan Outlet Boxes: Nonadjustable, designed for attachment of paddle fan weighing 70 lb (32 kg).

1. Listing and labeling: Paddle fan outlet boxes shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

I. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.

J. Cast-Metal Access, Pull, and Junction Boxes: Comply with NEMA FB 1 and UL 1773, galvanized, cast iron with gasketed cover.

K. Box extensions used to accommodate new building finishes shall be of same material as recessed box.

L. Device Box Dimensions: 4 inches by 2-1/8 inches by 2-1/8 inches deep (100 mm by 60 mm by 60 mm deep) .

M. Gangable boxes are allowed .

N. Hinged-Cover Enclosures: Comply with UL 50 and NEMA 250, [Type 1] [Type 3R] [Type 4] with continuous-hinge cover with flush latch unless otherwise indicated.

1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
2. Nonmetallic Enclosures: Plastic.
3. Interior Panels: Steel; all sides finished with manufacturer's standard enamel.

O. Cabinets:

1. NEMA 250, [Type 1] [Type 3R] galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
2. Hinged door in front cover with flush latch and concealed hinge.
3. Key latch to match panelboards.
4. Metal barriers to separate wiring of different systems and voltage.
5. Accessory feet where required for freestanding equipment.
6. Nonmetallic cabinets shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.7 HANDHOLES AND BOXES FOR EXTERIOR UNDERGROUND WIRING

A. General Requirements for Handholes and Boxes:

1. Boxes and handholes for use in underground systems shall be designed and identified as defined in NFPA 70, for intended location and application.
2. Boxes installed in wet areas shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Fiberglass Handholes and Boxes: Molded of fiberglass-reinforced polyester resin, with frame and covers of [polymer concrete] [reinforced concrete] [cast iron] [hot-dip galvanized-steel diamond plate] [fiberglass].

1. Standard: Comply with SCTE 77.
2. Configuration: Designed for flush burial with closed bottom unless otherwise indicated.
3. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure and handhole location.
4. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
5. Cover Legend: Molded lettering, "ELECTRIC."
6. Conduit Entrance Provisions: Conduit-terminating fittings shall mate with entering ducts for secure, fixed installation in enclosure wall.

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

A. Outdoors: Apply raceway products as specified below unless otherwise indicated:

1. Exposed Conduit: GRC, IMC or Type EPC-80-PVC.
2. Concealed Conduit, Aboveground: GRC, IMC, EMT, or RNC, Type EPC-40-PVC.
3. Underground Conduit: RNC, IMC, Type EPC-40-PVC direct buried unless noted otherwise on drawings.

4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC where exposed to physical damage, or LFNC.
5. Boxes and Enclosures, Aboveground: NEMA 250, [Type 3R] [Type 4].

B. Indoors: Apply raceway products as specified below unless otherwise indicated.

1. Exposed, Not Subject to Physical Damage: EMT, or RNC.
2. Exposed, Not Subject to Severe Physical Damage: EMT, or RNC identified for such use.
3. Exposed and Subject to Severe Physical Damage: GRC or IMC. Raceway locations include the following:

    a. Corridors used for traffic of mechanized carts, forklifts, and pallet-handling units.
    b. Mechanical rooms.

4. Concealed in Ceilings and Interior Walls and Partitions: EMT, IMC, or RNC, Type EPC-40-PVC.
5. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.
6. Damp or Wet Locations: GRC, IMC, or RNC, Type EPC 40 PVC where permitted above.
7. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4 nonmetallic in institutional and commercial kitchens and damp or wet locations.

C. Minimum Raceway Size: 1/2-inch (16-mm) for control wire 3/4-inch (21-mm) for power wir**e** trade size.

D. Raceway Fittings: Compatible with raceways and suitable for use and location.

1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.
2. PVC Externally Coated, Rigid Steel Conduits: Use only fittings listed for use with this type of conduit. Patch and seal all joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Use sealant recommended by fitting manufacturer and apply in thickness and number of coats recommended by manufacturer.
3. EMT: Use setscrew or compression, steel or cast-metal fittings. Comply with NEMA FB 2.10.
4. Flexible Conduit: Use only fittings listed for use with flexible conduit. Comply with NEMA FB 2.20.

E. Do not install aluminum conduits, boxes, or fittings in contact with concrete or earth.

F. Install surface raceways only where indicated on Drawings.

G. Do not install nonmetallic conduit where ambient temperature exceeds 120 deg F (49 deg C).

3.2 INSTALLATION

A. Comply with NECA 1 and NECA 101 for installation requirements except where requirements on Drawings or in this article are stricter. Comply with NECA 102 for aluminum conduits. Comply with NFPA 70 limitations for types of raceways allowed in specific occupancies and number of floors.

B. Keep raceways at least 6 inches (150 mm) away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.

C. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for hangers and supports.

D. Arrange stub-ups so curved portions of bends are not visible above finished slab.

E. Conceal conduit and EMT within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.

F. Support conduit within 12 inches (300 mm)of enclosures to which attached.

G. Raceways Embedded in Slabs:

1. Run conduit larger than 1-inch (27-mm) trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support. Secure raceways to reinforcement at maximum 10-foot (3-m) intervals.
2. Arrange raceways to cross building expansion joints at right angles with expansion fittings.
3. Arrange raceways to keep a minimum of 2 inches (50 mm) of concrete cover in all directions.
4. Do not embed threadless fittings in concrete unless specifically approved by Architect for each specific location.

H. Stub-ups to Above Recessed Ceilings:

1. Use EMT, IMC, or RMC for raceways.
2. Use a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.

I. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.

J. Coat field-cut threads on PVC-coated raceway with a corrosion-preventing conductive compound prior to assembly.

K. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install bushings on conduits up to 1-1/4-inch (35-mm) trade size and insulated throat metal bushings on 1-1/2-inch (41-mm) trade size and larger conduits terminated with locknuts. Install insulated throat metal grounding bushings on service conduits.

L. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb (90-kg) tensile strength. Leave at least 12 inches (300 mm) of slack at each end of pull wire. Cap underground raceways designated as spare above grade alongside raceways in use.

M. Surface Raceways:

1. Install surface raceway with a minimum 2-inch (50-mm) radius control at bend points.
2. Secure surface raceway with screws or other anchor-type devices at intervals not exceeding 48 inches (1200 mm) and with no less than two supports per straight raceway section. Support surface raceway according to manufacturer's written instructions. Tape and glue are not acceptable support methods.

N. Install raceway sealing fittings at accessible locations according to NFPA 70 and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces.

O. Install devices to seal raceway interiors at accessible locations. Locate seals so no fittings or boxes are between the seal and the following changes of environments. Seal the interior of all raceways at the following points:

1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
2. Where an underground service raceway enters a building or structure.
3. Where otherwise required by NFPA 70.

P. Expansion-Joint Fittings:

1. Install in each run of aboveground RNC that is located where environmental temperature change may exceed 30 deg F (17 deg C) and that has straight-run length that exceeds 25 feet (7.6 m).
2. Install type and quantity of fittings that accommodate temperature change listed for each of the following locations:

    a. Outdoor Locations Not Exposed to Direct Sunlight: 125 deg F (70 deg C) temperature change.
    b. Outdoor Locations Exposed to Direct Sunlight: 155 deg F (86 deg C) temperature change.
    c. Indoor Spaces Connected with Outdoors without Physical Separation: 125 deg F (70 deg C) temperature change.
    d. Attics: 135 deg F (75 deg C) temperature change.

3. Install fitting(s) that provide expansion and contraction for at least 0.00041 inch per foot of length of straight run per degree F (0.06 mm per meter of length of straight run per degree C) of temperature change for PVC conduits.
4. Install expansion fittings at all locations where conduits cross building or structure expansion joints.
5. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific

location at time of installation. Install conduit supports to allow for expansion movement.

Q. Flexible Conduit Connections: Comply with NEMA RV 3. Use a maximum of 72 inches (1830 mm) of flexible conduit for equipment subject to vibration, noise transmission, or movement; and for transformers and motors.

1. Use LFMC in damp or wet locations subject to severe physical damage.
2. Use LFMC or LFNC in damp or wet locations not subject to severe physical damage.

R. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements. Install boxes with height measured to [**center]** of box unless otherwise indicated.

S. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall. Prepare block surfaces to provide a flat surface for a raintight connection between the box and cover plate or the supported equipment and box.

T. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.

U. Locate boxes so that cover or plate will not span different building finishes.

V. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for the purpose.

W. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.

X. Set metal floor boxes level and flush with finished floor surface.

Y. Set nonmetallic floor boxes level. Trim after installation to fit flush with finished floor surface.

3.3 INSTALLATION OF UNDERGROUND CONDUIT

A. Direct-Buried Conduit:

1. Excavate trench bottom to provide firm and uniform support for conduit. Prepare trench bottom as specified in Section 312000 "Earth Moving" for pipe less than 6 inches (150 mm) in nominal diameter.
2. Install backfill as specified in Section 312000 "Earth Moving."
3. After installing conduit, backfill and compact. Start at tie-in point, and work toward end of conduit run, leaving conduit at end of run free to move with expansion and contraction as temperature changes during this process. Firmly hand tamp backfill around conduit to provide maximum supporting strength. After placing controlled backfill to within 12 inches (300 mm) of finished grade,

make final conduit connection at end of run and complete backfilling with normal compaction as specified in Section 312000 "Earth Moving."

4. Install manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through floor.

    a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches (75 mm) of concrete for a minimum of 12 inches (300 mm) on each side of the coupling.
    b. For stub-ups at equipment mounted on outdoor concrete bases and where conduits penetrate building foundations, extend steel conduit horizontally a minimum of 60 inches (1500 mm) from edge of foundation or equipment base. Install insulated grounding bushings on terminations at equipment.

5. Underground Warning Tape: Comply with requirements in Section 260553 "Identification for Electrical Systems."

3.4 INSTALLATION OF UNDERGROUND HANDHOLES AND BOXES

A. Install handholes and boxes level and plumb and with orientation and depth coordinated with connecting conduits to minimize bends and deflections required for proper entrances.

B. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1/2-inch (12.5-mm) sieve to No. 4 (4.75-mm) sieve and compacted to same density as adjacent undisturbed earth.

C. Elevation: In paved areas, set so cover surface will be flush with finished grade. Set covers of other enclosures 1 inch (25 mm) above finished grade.

D. Field-cut openings for conduits according to enclosure manufacturer's written instructions. Cut wall of enclosure with a tool designed for material to be cut. Size holes for terminating fittings to be used, and seal around penetrations after fittings are installed.

3.5 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 260544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

3.6 FIRESTOPPING

A. Install firestopping at penetrations of fire-rated floor and wall assemblies. Comply with requirements in Section 078413 "Penetration Firestopping."

3.7 PROTECTION

A. Protect coatings, finishes, and cabinets from damage and deterioration.

1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
2. Repair damage to PVC coatings or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION 260533

SECTION 260553

IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Identification for conductors.
2. Underground-line warning tape.
3. Warning labels and signs.
4. Instruction signs.
5. Equipment identification labels.
6. Miscellaneous identification products.

1.2 ACTION SUBMITTALS

A. Product Data: For each electrical identification product indicated.

1.3 QUALITY ASSURANCE

A. Comply with ANSI A13.1.

B. Comply with NFPA 70.

C. Comply with 29 CFR 1910.144 and 29 CFR 1910.145.

D. Comply with ANSI Z535.4 for safety signs and labels.

E. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.

PART 2 - PRODUCTS

2.1 CONDUCTOR IDENTIFICATION MATERIALS

A. Color-Coding Conductor Tape: Colored, self-adhesive vinyl tape not less than 3 mils (0.08 mm) thick by 1 to 2 inches (25 to 50 mm) wide.

2.2 FLOOR MARKING TAPE

A. 2-inch- (50-mm-) wide, 5-mil (0.125-mm) pressure-sensitive vinyl tape, with black and white stripes and clear vinyl overlay.

2.3 UNDERGROUND-LINE WARNING TAPE

A. Tape:

1. Recommended by manufacturer for the method of installation and suitable to identify and locate underground electrical and communications utility lines.
2. Printing on tape shall be permanent and shall not be damaged by burial operations.
3. Tape material and ink shall be chemically inert, and not subject to degrading when exposed to acids, alkalis, and other destructive substances commonly found in soils.

B. Color and Printing:

1. Comply with ANSI Z535.1 through ANSI Z535.5.
2. Inscriptions for Red-Colored Tapes: ELECTRIC LINE, HIGH VOLTAGE.
3. Inscriptions for Orange-Colored Tapes: TELEPHONE CABLE, CATV CABLE, COMMUNICATIONS CABLE, OPTICAL FIBER CABLE.

2.4 WARNING LABELS AND SIGNS

A. Comply with NFPA 70 and 29 CFR 1910.145.

B. Self-Adhesive Warning Labels: Factory-printed, multicolor, pressure-sensitive adhesive labels, configured for display on front cover, door, or other access to equipment unless otherwise indicated.

2.5 INSTRUCTION SIGNS

A. Engraved, laminated acrylic or melamine plastic, minimum 1/16 inch (1.6 mm) thick for signs up to 20 sq. inches (129 sq. cm) and 1/8 inch (3.2 mm) thick for larger sizes.

1. Engraved legend with black letters on white face.
2. Punched or drilled for mechanical fasteners.
3. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.

B. Adhesive Film Label: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch (10 mm).

C. Adhesive Film Label with Clear Protective Overlay: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch (10 mm). Overlay shall provide a weatherproof and UV-resistant seal for label.

2.6 EQUIPMENT IDENTIFICATION LABELS

A. Adhesive Film Label with Clear Protective Overlay: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch (10 mm). Overlay shall provide a weatherproof and UV-resistant seal for label.

B. Self-Adhesive, Engraved, Laminated Acrylic or Melamine Label: Adhesive backed, with white letters on a dark-gray background. Minimum letter height shall be 3/8 inch (10 mm).

C. Stenciled Legend: In nonfading, waterproof, black ink or paint. Minimum letter height shall be 1 inch (25 mm).

2.7 MISCELLANEOUS IDENTIFICATION PRODUCTS

A. Paint: Comply with requirements in painting Sections for paint materials and application requirements. Select paint system applicable for surface material and location (exterior or interior).

B. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.

B. Apply identification devices to surfaces that require finish after completing finish work.

C. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.

D. Attach signs and plastic labels that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.

E. System Identification Color-Coding Bands for Raceways and Cables: Each color-coding band shall completely encircle cable or conduit. Place adjacent bands of two-color markings in contact, side by side. Locate bands at changes in direction, at penetrations of walls and floors, at 50-foot (15-m) maximum intervals in straight runs, and at 25-foot (7.6-m) maximum intervals in congested areas.

F. Underground-Line Warning Tape: During backfilling of trenches install continuous underground-line warning tape directly above line at 6 to 8 inches (150 to 200 mm) below finished grade. Use multiple tapes where width of multiple lines installed in a common trench exceeds 16 inches (400 mm) overall.

G. Painted Identification: Comply with requirements in painting Sections for surface preparation and paint application.

3.2 IDENTIFICATION SCHEDULE

A. Accessible Raceways and Cables within Buildings: Identify the covers of each junction and pull box of the following systems with the wiring system legend. System legends shall be as follows:

1. Emergency Power.
2. UPS.

B. Power-Circuit Conductor Identification, 600 V or Less: For conductors in vaults, pull and junction boxes, manholes, and handholes, use color-coding conductor tape to identify the phase.

1. Color-Coding for Phase and Voltage Level Identification, 600 V or Less: Use colors listed below for ungrounded service, feeder, and branch-circuit conductors.

a. Color shall be factory applied[or field applied for sizes larger than No. 8 AWG, if authorities having jurisdiction permit.
b. Colors for 208/120-V Circuits:

1) Phase A: Black.
2) Phase B: Red.
3) Phase C: Blue.

c. Colors for 480/277-V Circuits:

1) Phase A: Brown.
2) Phase B: Orange.
3) Phase C: Yellow.

d. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches (150 mm) from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.

C. Conductors to Be Extended in the Future: Attach write-on tags to conductors and list source.

D. Locations of Underground Lines: Identify with underground-line warning tape for power, lighting, communication, and control wiring and optical fiber cable. Install underground-line warning tape for both direct-buried cables and cables in raceway.

E. Workspace Indication: Install floor marking tape to show working clearances in the direction of access to live parts. Workspace shall be as required by NFPA 70 and

29 CFR 1926.403 unless otherwise indicated. Do not install at flush-mounted panelboards and similar equipment in finished spaces.

F. Operating Instruction Signs: Install instruction signs to facilitate proper operation and maintenance of electrical systems and items to which they connect. Install instruction signs with approved legend where instructions are needed for system or equipment operation.

G. Emergency Operating Instruction Signs: Install instruction signs with white legend on a red background with minimum 3/8-inch- (10-mm-) high letters for emergency instructions at equipment used for power transfer.

H. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and the Operation and Maintenance Manual. Apply labels to disconnect switches and protection equipment, central or master units, control panels, control stations, terminal cabinets, and racks of each system. Systems include power, lighting, control, communication, signal, monitoring, and alarm systems unless equipment is provided with its own identification.

1. Labeling Instructions:

   a. Indoor Equipment: Adhesive film label, or Adhesive film label with clear protective overlay, or Self-adhesive, engraved, laminated acrylic or melamine label, or Engraved, laminated acrylic or melamine label. Unless otherwise indicated, provide a single line of text with 1/2-inch- (13-mm-) high letters on 1-1/2-inch- (38-mm-) high label; where two lines of text are required, use labels 2 inches (50 mm) high.
   b. Outdoor Equipment: Engraved, laminated acrylic or melamine label or Stenciled legend 4 inches (100 mm) high.
   c. Elevated Components: Increase sizes of labels and letters to those appropriate for viewing from the floor.
   d. Unless provided with self-adhesive means of attachment, fasten labels with appropriate mechanical fasteners that do not change the NEMA or NRTL rating of the enclosure.

END OF SECTION 260553

SECTION 262416

PANELBOARDS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes distribution panelboards and lighting and appliance branch-circuit panelboards.

1.2 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Panelboards shall withstand the effects of earthquake motions determined according to SEI/ASCE 7.

1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified [and the unit will be fully operational after the seismic event.

1.3 ACTION SUBMITTALS

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

B. Shop Drawings: For each panelboard and related equipment.

1. Show tabulations of installed devices, equipment features, and ratings.
2. Detail enclosure types and details for types other than NEMA 250, Type 1.
3. Detail bus configuration, current, and voltage ratings.
4. Short-circuit current rating of panelboards and overcurrent protective devices.
5. Include evidence of NRTL listing for series rating of installed devices.
6. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
7. Include time-current coordination curves for each type and rating of overcurrent protective device included in panelboards.

1.4 INFORMATIONAL SUBMITTALS

A. Seismic Qualification Certificates: Submit certification that panelboards, overcurrent protective devices, accessories, and components will withstand seismic forces defined in Section 260548 "Vibration and Seismic Controls for Electrical Systems."

B. Panelboard schedules for installation in panelboards.

1.5 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.6 QUALITY ASSURANCE

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. Comply with NEMA PB 1.

C. Comply with NFPA 70.

1.7 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace devices that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR PANELBOARDS

A. Enclosures: Flush- and surface-mounted cabinets.

1. Rated for environmental conditions at installed location.

a. Indoor Dry and Clean Locations: NEMA 250, Type 1
b. Outdoor Locations: NEMA 250, Type 3R.
c. Kitchens or Wash-Down areas: NEMA 250, Type 4X.
d. Other Wet or Damp Indoor Locations: NEMA 250, Type 4.

2. Directory Card: Inside panelboard door, mounted in transparent card holder.

B. Incoming Mains Location: Top or bottom.

C. Phase, Neutral, and Ground Buses: Tin-plated aluminum or Hard-drawn copper, 98 percent conductivity.

D. Conductor Connectors: Suitable for use with conductor material and sizes.

1. Material: Tin-plated aluminum or Hard-drawn copper, 98 percent conductivity.
2. Main and Neutral Lugs: Compression or Mechanical type.
3. Ground Lugs and Bus Configured Terminators: Compression or Mechanical type.

4. Feed-Through Lugs: Compression or Mechanical type, suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device.
5. Subfeed (Double) Lugs: Compression or Mechanical type suitable for use with conductor material. Locate at same end of bus as incoming lugs or main device.

E. Service Equipment Label: NRTL labeled for use as service equipment for panelboards with one or more main service disconnecting and overcurrent protective devices.

F. Future Devices: Mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices.

G. Panelboard Short-Circuit Current Rating: Rated for series-connected system with integral or remote upstream overcurrent protective devices and labeled by an NRTL. Include size and type of allowable upstream and branch devices, and listed and labeled for series-connected short-circuit rating by an NRTL.

H. Panelboard Short-Circuit Current Rating: Fully rated to interrupt symmetrical short-circuit current available at terminals.

2.2 DISTRIBUTION PANELBOARDS

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

1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
3. Siemens Energy & Automation, Inc.
4. Square D; a brand of Schneider Electric.

B. Panelboards: NEMA PB 1, power and feeder distribution type.

C. Doors: Secured with vault-type latch with tumbler lock; keyed alike.

D. Mains: Circuit breaker or Lugs only as indicated on drawings.

E. Branch Overcurrent Protective Devices: For Circuit-Breaker Frame Sizes 125 A and Smaller: Plug-in or Bolt-on circuit breakers.

F. Branch Overcurrent Protective Devices: For Circuit-Breaker Frame Sizes Larger Than 125 A: Bolt-on circuit breakers; plug-in circuit breakers where individual positive-locking device requires mechanical release for removal.

2.3 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

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

1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.

2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
3. Siemens Energy & Automation, Inc.
4. Square D; a brand of Schneider Electric.

B. Panelboards: NEMA PB 1, lighting and appliance branch-circuit type.

C. Mains: Circuit breaker or lugs only as indicated on drawings.

D. Branch Overcurrent Protective Devices: Plug-in or Bolt-on circuit breakers, replaceable without disturbing adjacent units.

E. Doors: Concealed hinges; secured with flush latch with tumbler lock; keyed alike.

2.4 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

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

1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
3. Siemens Energy & Automation, Inc.
4. Square D; a brand of Schneider Electric.

B. Molded-Case Circuit Breaker (MCCB): Comply with UL 489, with series-connected rating to meet available fault currents.

1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads, and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
2. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
3. Electronic trip circuit breakers with rms sensing; field-replaceable rating plug or field-replicable electronic trip; and the following field-adjustable settings:

    a. Instantaneous trip.
    b. Long- and short-time pickup levels.
    c. Long- and short-time time adjustments.
    d. Ground-fault pickup level, time delay, and I^2t response.
4. GFCI Circuit Breakers: Single- and two-pole configurations with Class A ground-fault protection (6-mA trip).
5. Ground-Fault Equipment Protection (GFEP) Circuit Breakers: Class B ground-fault protection (30-mA trip).
6. Arc-Fault Circuit Interrupter (AFCI) Circuit Breakers: Comply with UL 1699; 120/240-V, single-pole configuration.
7. Molded-Case Circuit-Breaker (MCCB) Features and Accessories:

    a. Standard frame sizes, trip ratings, and number of poles.
    b. Lugs: Compression or Mechanical style, suitable for number, size, trip ratings, and conductor materials.

c. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge (HID) lighting circuits.
d. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
e. Shunt Trip: [120] [24] V trip coil energized from separate circuit, set to trip at [55] [75] percent of rated voltage.
f. Handle Padlocking Device: Fixed attachment, for locking circuit-breaker handle in on or off position.
g. Handle Clamp: Loose attachment, for holding circuit-breaker handle in on position.

C. Fused Switch: NEMA KS 1, Type HD; clips to accommodate specified fuses; lockable handle.

1. Fuses, and Spare-Fuse Cabinet: Comply with requirements specified in Section 262813 "Fuses."

PART 3 - EXECUTION

3.1 INSTALLATION

A. Receive, inspect, handle, store and install panelboards and accessories according to NECA 407 or NEMA PB 1.1.

B. Mount top of trim 90 inches (2286 mm above finished floor unless otherwise indicated.

C. Mount panelboard cabinet plumb and rigid without distortion of box. Mount recessed panelboards with fronts uniformly flush with wall finish and mating with back box.

D. Install overcurrent protective devices and controllers not already factory installed.

1. Set field-adjustable, circuit-breaker trip ranges.

E. Install filler plates in unused spaces.

F. Stub four 1-inch (27-GRC) empty conduits from panelboard into accessible ceiling space or space designated to be ceiling space in the future. Stub four 1-inch (27-GRC) empty conduits into raised floor space or below slab not on grade.

G. Arrange conductors in gutters into groups and bundle and wrap with wire ties.

H. Comply with NECA 1.

3.2 IDENTIFICATION

A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs complying with Section 260553 "Identification for Electrical Systems."

B. Create a directory to indicate installed circuit loads and incorporating Owner's final room designations. Obtain approval before installing. Use a computer or typewriter to create directory; handwritten directories are not acceptable.

C. Panelboard Nameplates: Label each panelboard with a nameplate complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.3 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Acceptance Testing Preparation:

1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
2. Test continuity of each circuit.

C. Tests and Inspections:

1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

D. Panelboards will be considered defective if they do not pass tests and inspections.

END OF SECTION 262416

SECTION 262726

WIRING DEVICES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Receptacles, receptacles with integral GFCI, and associated device plates.
2. Weather-resistant receptacles.
3. Snap switches and wall-box dimmers.
4. Solid-state fan speed controls.
5. Wall-switch and exterior occupancy sensors.
6. Communications outlets.

1.2 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Receptacles for Owner-Furnished Equipment: Match plug configurations.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers' Names: Shortened versions (shown in parentheses) of the following manufacturers' names are used in other Part 2 articles:

1. Cooper Wiring Devices; Division of Cooper Industries, Inc. (Cooper).
2. Hubbell Incorporated; Wiring Device-Kellems (Hubbell).
3. Leviton Mfg. Company Inc. (Leviton).
4. Pass & Seymour/Legrand (Pass & Seymour).

B. Source Limitations: Obtain each type of wiring device and associated wall plate from single source from single manufacturer.

2.2 GENERAL WIRING-DEVICE REQUIREMENTS

A. Wiring Devices, Components, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with NFPA 70.

C. Devices that are manufactured for use with modular plug-in connectors may be substituted under the following conditions:

1. Connectors shall comply with UL 2459 and shall be made with stranding building wire.
2. Devices shall comply with the requirements in this Section.

2.3 STRAIGHT-BLADE RECEPTACLES

A. Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498, and FS W-C-596.

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

a. Cooper; 5351 (single), CR5362 (duplex).
b. Hubbell; HBL5351 (single), HBL5352 (duplex).
c. Leviton; 5891 (single), 5352 (duplex).
d. Pass & Seymour; 5361 (single), 5362 (duplex).

2.4 GFCI RECEPTACLES

A. General Description:

1. Straight blade, feed-through type.
2. Comply with NEMA WD 1, NEMA WD 6, UL 498, UL 943 Class A, and FS W-C-596.
3. Include indicator light that shows when the GFCI has malfunctioned and no longer provides proper GFCI protection.

B. Duplex GFCI Convenience Receptacles, 125 V, 20 A:

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

a. Cooper; VGF20.
b. Hubbell; GFR5352L.
c. Pass & Seymour; 2095.
d. Leviton; 7590.

2.5 TOGGLE SWITCHES

A. Comply with NEMA WD 1, UL 20, and FS W-S-896.

B. Switches, 120/277 V, 20 A:

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

1) Single Pole:

2) Cooper; AH1221.
3) Hubbell; HBL1221.
4) Leviton; 1221-2.
5) Pass & Seymour; CSB20AC1.

6) Two Pole:

7) Cooper; AH1222.
8) Hubbell; HBL1222.
9) Leviton; 1222-2.
10) Pass & Seymour; CSB20AC2.

11) Three Way:

12) Cooper; AH1223.
13) Hubbell; HBL1223.
14) Leviton; 1223-2.
15) Pass & Seymour; CSB20AC3.

16) Four Way:

17) Cooper; AH1224.
18) Hubbell; HBL1224.
19) Leviton; 1224-2.
20) Pass & Seymour; CSB20AC4.

2.6 DECORATOR-STYLE DEVICES

A. Convenience Receptacles: Square face, 125 V, 15 A; comply with NEMA WD 1, NEMA WD 6 Configuration 5-15R, and UL 498.

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

a. Cooper; 6252.
b. Hubbell; DR15.
c. Leviton; 16252.
d. Pass & Seymour; 26252.

B. GFCI, Feed-Through Type, Convenience Receptacles: Square face, 125 V, 15 A; comply with NEMA WD 1, NEMA WD 6 Configuration 5-15R, UL 498, and UL 943 Class A.

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

a. Cooper; VGF15.
b. Hubbell; GF15LA.
c. Leviton; 8599.
d. Pass & Seymour; 1594.

C. Toggle Switches, Square Face, 120/277 V, 15 A: Comply with NEMA WD 1, UL 20, and FS W-S-896.

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

a. Cooper; 7621 (single pole), 7623 (three way).
b. Hubbell; DS115 (single pole), DS315 (three way).
c. Leviton; 56291-2 (single pole), 5623-2 (three way).
d. Pass & Seymour; 2621 (single pole), 2623 (three way).

2.7 RESIDENTIAL DEVICES

A. Fan Speed Controls:

1. Modular, 120-V, full-wave, solid-state units with integral, quiet on-off switches and audible frequency and EMI/RFI filters.
2. Comply with UL 1917.
3. Continuously adjustable slider, 5 A
4. Three-speed adjustable slider 1.5 A.

B. Telephone Outlet:

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

a. Cooper; 3560-6.
b. Leviton; 40649.

2. Description: Single RJ-45 jack for terminating 100-ohm, balanced, four-pair UTP; TIA/EIA-568-B.1; complying with Category 5e. Comply with UL 1863.

C. Combination TV and Telephone Outlet:

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

a. Cooper; 3562.
b. Leviton; 40159.

2. Description: Single RJ-45 jack for 100-ohm, balanced, four-pair UTP; TIA/EIA-568-B.1; complying with Category 5e. Comply with UL 1863.

2.8 WALL-BOX DIMMERS

A. Dimmer Switches: Modular, full-wave, solid-state units with integral, quiet on-off switches, with audible frequency and EMI/RFI suppression filters.

B. Control: Continuously adjustable slider; with single-pole or three-way switching. Comply with UL 1472.

C. Incandescent Lamp Dimmers: 120 V; control shall follow square-law dimming curve. On-off switch positions shall bypass dimmer module.
   1. 1800 watts (15 Amps).]

D. Fluorescent Lamp Dimmer Switches: Modular; compatible with dimmer ballasts; trim potentiometer to adjust low-end dimming; dimmer-ballast combination capable of consistent dimming with low end not greater than 20 percent of full brightness.

2.9 WALL PLATES

A. Single and combination types shall match corresponding wiring devices.

   1. Plate-Securing Screws: Metal with head color to match plate finish.
   2. Material for Finished Spaces: Smooth, high-impact thermoplastic.
   3. Material for Unfinished Spaces: **Smooth, high-impact thermoplastic**.
   4. Material for Damp Locations: **Thermoplastic** with spring-loaded lift cover, and listed and labeled for use in wet and damp locations.

B. Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with Type 3R, weather-resistant, thermoplastic with lockable cover.

2.10 FINISHES

A. Device Color:

   1. Wiring Devices Connected to Normal Power System: As selected by Architect unless otherwise indicated or required by NFPA 70 or device listing.

B. Wall Plate Color: For plastic covers, match device color.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with NECA 1, including mounting heights listed in that standard, unless otherwise indicated.

B. Coordination with Other Trades:

   1. Protect installed devices and their boxes. Do not place wall finish materials over device boxes and do not cut holes for boxes with routers that are guided by riding against outside of boxes.
   2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.

3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
4. Install wiring devices after all wall preparation, including painting, is complete.

C. Conductors:

1. Do not strip insulation from conductors until right before they are spliced or terminated on devices.
2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
3. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtails.
4. Existing Conductors:

    a. Cut back and pigtail, or replace all damaged conductors.
    b. Straighten conductors that remain and remove corrosion and foreign matter.
    c. Pigtailing existing conductors is permitted, provided the outlet box is large enough.

D. Device Installation:

1. Replace devices that have been in temporary use during construction and that were installed before building finishing operations were complete.
2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
4. Connect devices to branch circuits using pigtails that are not less than 6 inches (152 mm) in length.
5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, two-thirds to three-fourths of the way around terminal screw.
6. Use a torque screwdriver when a torque is recommended or required by manufacturer.
7. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.
8. Tighten unused terminal screws on the device.
9. When mounting into metal boxes, remove the fiber or plastic washers used to hold device-mounting screws in yokes, allowing metal-to-metal contact.

E. Receptacle Orientation:

1. Install ground pin of vertically mounted receptacles down, and on horizontally mounted receptacles to the right.

F. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.

G. Dimmers:

1. Install dimmers within terms of their listing.
2. Verify that dimmers used for fan speed control are listed for that application.
3. Install unshared neutral conductors on line and load side of dimmers according to manufacturers' device listing conditions in the written instructions.

H. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on top. Group adjacent switches under single, multigang wall plates.

I. Adjust locations of service poles to suit arrangement of partitions and furnishings.

3.2 GFCI RECEPTACLES

A. Install non-feed-through-type GFCI receptacles where protection of downstream receptacles is not required.

3.3 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Test Instruments: Use instruments that comply with UL 1436.
2. Test Instrument for Convenience Receptacles: Digital wiring analyzer with digital readout or illuminated digital-display indicators of measurement.

B. Tests for Convenience Receptacles:

1. Line Voltage: Acceptable range is 105 to 132 V.
2. Percent Voltage Drop under 15-A Load: A value of 6 percent or higher is unacceptable.
3. Ground Impedance: Values of up to 2 ohms are acceptable.
4. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.
5. Using the test plug, verify that the device and its outlet box are securely mounted.
6. Tests shall be diagnostic, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault current path, defective devices, or similar problems. Correct circuit conditions, remove malfunctioning units and replace with new ones, and retest as specified above.

C. Wiring device will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

END OF SECTION 262726

SECTION 265100

INTERIOR LIGHTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Interior lighting fixtures, lamps, and ballasts.
2. Emergency lighting units.
3. Exit signs.
4. Lighting fixture supports.

B. Related Sections:

1. Section 260923 "Lighting Control Devices" for automatic control of lighting, including time switches, photoelectric relays, occupancy sensors, and multipole lighting relays and contactors.
2. Section 262726 "Wiring Devices" for manual wall-box dimmers for incandescent lamps.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of lighting fixture, arranged in order of fixture designation. Include data on features, accessories, and finishes.

1.3 QUALITY ASSURANCE

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. Comply with NFPA 70.

PART 2 - PRODUCTS

A. Refer to light fixture schedule on electrical construction documents.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Lighting fixtures: Set level, plumb, and square with ceilings and walls. Install lamps in each fixture.

B. Comply with NFPA 70 for minimum fixture supports.

C. Suspended Lighting Fixture Support:

1. Pendants and Rods: Where longer than 48 inches (1200 mm), brace to limit swinging.
2. Stem-Mounted, Single-Unit Fixtures: Suspend with twin-stem hangers.
3. Continuous Rows: Use tubing or stem for wiring at one point and tubing or rod for suspension for each unit length of fixture chassis, including one at each end.

D. Adjust aimable lighting fixtures to provide required light intensities.

E. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

3.2 FIELD QUALITY CONTROL

A. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery and retransfer to normal.

END OF SECTION 265100

SECTION 265600

EXTERIOR LIGHTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Exterior luminaires with lamps and ballasts.
2. Luminaire-mounted photoelectric relays.
3. Poles and accessories.

1.2 STRUCTURAL ANALYSIS CRITERIA FOR POLE SELECTION

A. Dead Load: Weight of luminaire and its horizontal and vertical supports, lowering devices, and supporting structure, applied as stated in AASHTO LTS-4-M.

B. Live Load: Single load of 500 lbf (2224 N), distributed as stated in AASHTO LTS-4-M.

C. Ice Load: Load of 3 lbf/sq. ft. (145 Pa), applied as stated in AASHTO LTS-4-M Ice Load Map.

D. Wind Load: Pressure of wind on pole and luminaire and banners and banner arms, calculated and applied as stated in AASHTO LTS-4-M.

1. Basic wind speed for calculating wind load for poles exceeding 49.2 feet (15 m) in height is 100 mph (45 m/s)

a. Wind Importance Factor: 1.0]
b. Minimum Design Life: 50 years
c. Velocity Conversion Factors: 1.0

2. Basic wind speed for calculating wind load for poles 50 feet (15 m) high or less is 100 mph (45 m/s)

a. Table 3-2>.
b. Minimum Design Life: 25 years
c. Velocity Conversion Factors: 1.0

1.3 ACTION SUBMITTALS

A. Product Data: For each luminaire, pole, and support component, arranged in order of lighting unit designation. Include data on features, accessories, and finishes.

1.4 QUALITY ASSURANCE

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. Comply with IEEE C2, "National Electrical Safety Code."

C. Comply with NFPA 70.

PART 2 - PRODUCTS

A. Refer to light fixture schedule on electrical construction documents.

PART 3 - EXECUTION

3.1 LUMINAIRE INSTALLATION

A. Install lamps in each luminaire.

B. Fasten luminaire to indicated structural supports.

C. Adjust luminaires that require field adjustment or aiming.

3.2 POLE INSTALLATION

A. Alignment: Align pole foundations and poles for optimum directional alignment of luminaires and their mounting provisions on the pole.

B. Clearances: Maintain the following minimum horizontal distances of poles from surface and underground features unless otherwise indicated on Drawings:

1. Fire Hydrants and Storm Drainage Piping: 60 inches (1520 mm).
2. Water, Gas, Electric, Communication, and Sewer Lines: 10 feet (3 m).
3. Trees: 15 feet (5 m) from tree trunk.

C. Concrete Pole Foundations: Set anchor bolts according to anchor-bolt templates furnished by pole manufacturer. Concrete materials, installation, and finishing requirements are specified in Section 033000 "Cast-in-Place Concrete."

D. Foundation-Mounted Poles: Mount pole with leveling nuts, and tighten top nuts to torque level recommended by pole manufacturer.

1. Use anchor bolts and nuts selected to resist seismic forces defined for the application and approved by manufacturer.
2. Grout void between pole base and foundation. Use nonshrink or expanding concrete grout firmly packed to fill space.
3. Install base covers unless otherwise indicated.

4. Use a short piece of 1/2-inch- (13-mm-) diameter pipe to make a drain hole through grout. Arrange to drain condensation from interior of pole.

E. Embedded Poles with Tamped Earth Backfill: Set poles to depth below finished grade indicated on Drawings, but not less than one-sixth of pole height.

1. Dig holes large enough to permit use of tampers in the full depth of hole.
2. Backfill in 6-inch (150-mm) layers and thoroughly tamp each layer so compaction of backfill is equal to or greater than that of undisturbed earth.

F. Embedded Poles with Concrete Backfill: Set poles in augered holes to depth below finished grade indicated on Drawings, but not less than one-sixth of pole height.

1. Make holes 6 inches (150 mm) in diameter larger than pole diameter.
2. Fill augered hole around pole with air-entrained concrete having a minimum compressive strength of 3000 psi (20 MPa) at 28 days, and finish in a dome above finished grade.
3. Use a short piece of 1/2-inch- (13-mm-) diameter pipe to make a drain hole through concrete dome. Arrange to drain condensation from interior of pole.
4. Cure concrete a minimum of 72 hours before performing work on pole.

G. Poles and Pole Foundations Set in Concrete Paved Areas: Install poles with minimum of 6-inch- (150-mm-) wide, unpaved gap between the pole or pole foundation and the edge of adjacent concrete slab. Fill unpaved ring with pea gravel to a level 1 inch (25 mm) below top of concrete slab.

H. Raise and set poles using web fabric slings (not chain or cable).

3.3 INSTALLATION OF INDIVIDUAL GROUND-MOUNTED LUMINAIRES

A. Install on concrete base with top [4 inches (100 mm)] <Insert dimension> above finished grade or surface at luminaire location. Cast conduit into base, and finish by troweling and rubbing smooth. Concrete materials, installation, and finishing are specified in Section 033000 "Cast-in-Place Concrete."

3.4 CORROSION PREVENTION

A. Aluminum: Do not use in contact with earth or concrete. When in direct contact with a dissimilar metal, protect aluminum by insulating fittings or treatment.

B. Steel Conduits: Comply with Section 260533 "Raceways and Boxes for Electrical Systems." In concrete foundations, wrap conduit with 0.010-inch- (0.254-mm-) thick, pipe-wrapping plastic tape applied with a 50 percent overlap.

3.5 GROUNDING

A. Ground metal poles and support structures according to Section 260526 "Grounding and Bonding for Electrical Systems."

1. Install grounding electrode for each pole unless otherwise indicated.
2. Install grounding conductor pigtail in the base for connecting luminaire to grounding system.

B. Ground nonmetallic poles and support structures according to Section 260526 "Grounding and Bonding for Electrical Systems."

1. Install grounding electrode for each pole.
2. Install grounding conductor and conductor protector.
3. Ground metallic components of pole accessories and foundations.

END OF SECTION 265600

SECTION 280000

Security Design & Camera Locations

PART 1 - GENERAL

1.1 Summary

A. Tenants will access the building main entrance door and community room exterior door using a key FOB reader device. The Owner may also direct for the same FOB reader device to be used as access for shared common areas, and support service areas. Areas include:
   1. Laundry (3rd Party Laundry Equipment Service Providers may require controlled access and security camera in room where a Cash to Card/Coin machine is located).
   2. Fitness.
   3. Community Space.
   4. Computer / Media Space.
   5. All other exterior and unit entries shall be accessed with a key.

B. Door “prop-open” alarms shall be provided at all exterior doors. Alarm notification should go the Manager’s Office and provide local notification; alarm should silence when door is shut.

C. A Security Camera system is required and shall monitor all building exits/entrances and parking lots if budget allows. The system is to be monitored from the Manager’s Office. Verify with National Church Residences if CCTV system is to be recorded. If affirmative, verify time capacity and how it will be recorded (electronic recording is recommended). For renovation work, existing systems to be evaluated to determine if upgrade is warranted.

END OF SECTION 280513

SECTION 32 92 00

TURF AND GRASSES

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. Seeding.
2. Sodding.
3. Turf renovation.

B. Related Requirements:

1. Section 329300 "Plants" for trees, shrubs, ground covers, and other plants as well as border edgings and mow strips.

1.3 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. See drawing designations for planting soils.

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.

1.4 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. Professional Membership: Installer shall be a member in good standing of either the National Association of Landscape Professionals or AmericanHort.
2. Experience: Three years' experience in turf installation in addition to requirements in Section 014000 "Quality Requirements."
3. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on Project site when work is in progress.

4. 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. Planting Restrictions: Plant during one of the following periods. Coordinate planting periods with initial maintenance periods to provide required maintenance from date of Substantial Completion.

1. Spring Planting: March 15 to June 15.
2. Fall Planting: August 15 to October 15.

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.

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: 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:
2. Sun and Partial Shade: Proportioned by weight as follows:

a. 70 percent turf-type tall fescue.
b. 20 percent perennial ryegrass (Lolium perenne).
c. 10 percent Kentucky bluegrass (Poa pratensis).

2.2 TURFGRASS SOD

A. Turfgrass Sod: Approved, 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.

B. Turfgrass Species: Turf-type tall fescue (Festuca arundinacea), shade tolerant blend.

C. Turfgrass Species: Sod of grass species as follows, with not less than 85 percent germination, not less than 95 percent pure seed, and not more than 0.5 percent weed seed:

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: 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: 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. Sphagnum Peat Mulch: Partially decomposed sphagnum peat moss, finely divided or of granular texture, and with a pH range of 3.4 to 4.8.

C. Fiber Mulch: Biodegradable, dyed-wood, cellulose-fiber mulch; nontoxic and free of plant-growth or germination inhibitors; with a maximum moisture content of 15 percent and a pH range of 4.5 to 6.5.

D. Nonasphaltic Tackifier: Colloidal tackifier recommended by fiber-mulch manufacturer for slurry application; nontoxic and free of plant-growth or germination inhibitors.

E. Asphalt Emulsion: ASTM D977, Grade SS-1; nontoxic and free of plant-growth or germination inhibitors.

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.

B. Pre-Emergent Herbicide (Selective and Nonselective): Effective for controlling the germination or growth of weeds within planted areas at the soil level directly below the mulch layer.

C. Post-Emergent Herbicide (Selective and Nonselective): Effective for controlling weed growth that has already germinated.

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 adjacent and adjoining areas from hydroseeding and hydromulching overspray.
2. 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. General: Prepare planting area for soil placement and mix planting soil.

B. 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.

C. Moisten prepared area before planting if soil is dry. Water thoroughly and allow surface to dry before planting. Do not create muddy soil.

D. Before planting, obtain Architect's acceptance of finish grading; restore planting areas if eroded or otherwise disturbed after finish grading.

3.4 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. Bond straw mulch by spraying with asphalt emulsion at a rate of 10 to 13 gal./1000 sq. ft.. Take precautions to prevent damage or staining of structures or other plantings adjacent to mulched areas. Immediately clean damaged or stained areas.

3.5 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.

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.

3.6 TURF RENOVATION

A. Renovate existing turf where indicated.

B. Renovate turf damaged by Contractor's operations, such as storage of materials or equipment and movement of vehicles.

1. Reestablish turf where settlement or washouts occur or where minor regrading is required.

2. Install new planting soil as required.

C. Remove sod and vegetation from diseased or unsatisfactory turf areas; do not bury in soil.

D. Remove topsoil containing foreign materials, such as oil drippings, fuel spills, stones, gravel, and other construction materials resulting from Contractor's operations, and replace with new planting soil.

E. Mow, dethatch, core aerate, and rake existing turf.

F. Remove weeds before seeding. Where weeds are extensive, apply selective herbicides as required. Do not use pre-emergence herbicides.

G. Remove waste and foreign materials, including weeds, soil cores, grass, vegetation, and turf, and legally dispose of them off Owner's property.

H. Till stripped, bare, and compacted areas thoroughly to a soil depth of 6 inches.

I. Apply initial fertilizer required for establishing new turf and mix thoroughly into top 4 inches of existing soil. Install new planting soil to fill low spots and meet finish grades.
1. Initial Fertilizer: Slow-release fertilizer applied according to manufacturer's recommendations.

J. Apply seed and protect with straw mulch as required for new turf.

K. Water newly planted areas and keep moist until new turf is established.

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. Schedule initial and subsequent mowings to maintain the following grass height:
1. Mow turf-type tall fescue to a height of 2 to 3 inches.

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.

B. Post-Emergent Herbicides (Selective and Nonselective): Apply only as necessary to treat already-germinated weeds and according to manufacturer's written recommendations.

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.

3.11 MAINTENANCE SERVICE

A. Turf Maintenance Service: Provide full maintenance by skilled employees of landscape Installer. Maintain as required in "Turf Maintenance" Article. Begin maintenance immediately after each area is planted and continue until acceptable turf is established, but for not less than the following periods:

1. Seeded Turf: 30 days from date of Substantial Completion.

    a. When initial maintenance period has not elapsed before end of planting season, or if turf is not fully established, continue maintenance during next planting season.

2. Sodded Turf: 30 days from date of Substantial Completion.

END OF SECTION 329200

SECTION 32 93 00

PLANTS

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. Plants.
2. Weed Control Fabric

B. Related Requirements:
1. Section 329200 "Turf and Grasses" for turf.

1.3 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 sizes indicated; 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 sizes indicated.

D. 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.

E. Finish Grade: Elevation of finished surface of planting soil.

F. 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.

G. 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.

H. Planting Area: Areas to be planted.

I. 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.

J. 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.

K. 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.

L. Stem Girdling Roots: Roots that encircle the stems (trunks) of trees below the soil surface.

M. 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.

1.4 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.

1.5 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 Verification: For each of the following:

1. 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.

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. Pesticides and Herbicides: Product label and manufacturer's application instructions specific to Project.

C. 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. Professional Membership: Installer shall be a member in good standing of either the Professional Landcare Network or the American Nursery and Landscape Association.
2. Experience: Three years' experience in landscape installation.
3. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on Project site when work is in progress.
4. Pesticide Applicator: State licensed, commercial.

B. Provide quality, size, genus, species, and variety of plants indicated, complying with applicable requirements in ANSI Z60.1.

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.

1.9 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. 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.

D. Handle planting stock by root ball.

E. Apply antidesiccant to trees and shrubs using power spray to provide an adequate film over trunks, 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.

F. 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.

G. 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. Set balled stock on ground and cover ball with soil, peat moss, sawdust, or other acceptable material.
2. Do not remove container-grown stock from containers before time of planting.
3. 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. Planting Restrictions: Plant during one of the following periods. Coordinate planting periods with maintenance periods to provide required maintenance from date of Substantial Completion.

1. Spring Planting: March 15 to June 15.
2. Fall Planting: August 15 to October 15.

C. 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.

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.

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.

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: As indicated on plans.

2.4 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.

B. Pre-Emergent Herbicide (Selective and Nonselective): Effective for controlling the germination or growth of weeds within planted areas at the soil level directly below the mulch layer.

C. Post-Emergent Herbicide (Selective and Nonselective): Effective for controlling weed growth that has already germinated.

2.5 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.

C. Weed Control Fabric: Nonwoven geotextile manufactured for separation applications and made of polypropylene, polyolefin, or polyester fibers or combination of them.

D. Mycorrhizal Fungi: Dry, granular inoculant containing at least 5300 spores per lb of vesicular-arbuscular mycorrhizal fungi and 95 million spores per lb of ectomycorrhizal fungi, 33 percent hydrogel, and a maximum of 5.5 percent inert material.

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.

3.3 PLANTING AREA ESTABLISHMENT

A. General: Prepare planting area for soil placement and mix planting soil according to …

B. Placing Planting Soil: Place manufactured planting soil over exposed subgrade.

C. Before planting, obtain Architect's acceptance of finish grading; restore planting areas if eroded or otherwise disturbed after finish grading.

D. Application of Mycorrhizal Fungi: At time directed by Architect, broadcast dry product uniformly over prepared soil at application rate according to manufacturer's written recommendations.

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 for balled and burlapped stock.
3. Do not excavate deeper than depth of the root ball, measured from the root flare to the bottom of the root ball.
4. 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.
5. 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.
6. Maintain supervision of excavations during working hours.
7. Keep excavations covered or otherwise protected when unattended by Installer's personnel.

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.

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 2 inches 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: Two per plant.

5. Continue backfilling process. Water again after placing and tamping final layer of soil.

D. Container-Grown Stock: Set each plant plumb and in center of planting pit or trench with root flare 2 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. 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 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.

3.8 PLANTING AREA MULCHING

A. Mulch backfilled surfaces of planting areas and other areas indicated.

1. Trees 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 3 inches of trunks or stems.
2. Install weed-control fabric in all plant beds before mulching excluding individual trees in lawn areas. Overlap fabric 6” min.
3. Organic Mulch in Planting Areas: Apply 3-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.

3.9 EDGING INSTALLATION

A. Shovel-Cut Edging: Separate mulched areas from turf areas with a 45-degree, 4- to 6-inch- deep, shovel-cut edge.

3.10 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.

3.11 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.

B. Pre-Emergent Herbicides (Selective and Nonselective): Apply to tree, shrub, and ground-cover areas according to manufacturer's written recommendations. Do not apply to seeded areas.

C. Post-Emergent Herbicides (Selective and Nonselective): Apply only as necessary to treat already-germinated weeds and according to manufacturer's written recommendations.

3.12 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 before the end of the corrections period or are damaged during construction operations that Architect determines are incapable of restoring to normal growth pattern.

1. Species of Replacement Trees: Same species being replaced.

3.13 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.

END OF SECTION 329300