PROJECT MANUAL
LATRINE MODERNIZATION

RI Army National Guard
Warwick, RI

RGB #6356
May 2019

50 Holden Street · Providence, RI 02908 · Tel: (401) 272-1730 · www.rgb.net
Architecture · Project Management · Interior Design

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SECTION 00 04 10 - BID FORM

TO: Attention: Ann Marie Ethier

Rhode Island Army National Guard
Construction and Facilities Management Office
705 New London Avenue
Cranston, RI 02920

FROM: _____

_____

_____

Pursuant to and in compliance with your Bidding Requirements, the undersigned hereby offers to furnish all plant, labor, materials, supplies, equipment and other facilities and things necessary or proper for or incidental to the entire project as required by and in strict accordance with the Drawings and Project Manual entitled,

Warwick Armory Latrine

Warwick, RI

RI Army National Guard

and of all Addenda (Nos. 1 through ___) issued by the Architect, The Robinson Green Beretta Corporation, in accordance with the Bidding Requirements for the lump sum base bid price of

_____

_____($_____).

ALLOWANCES:

Allowances are specified in Division 1 of the specifications. For Additional Work identified, identified potential unforeseen conditions, and work to be performed under this Contract for the Work described in the Allowances, the undersigned agrees to include in his Base Bid by the following sums; which remain in effect for the life of the Agreement until removed by Change Order unless specifically noted otherwise.

Allowance #1 Material Testing	$ 2,500
Allowance #2 Unforeseen Conditions requiring Remedial Work	$ 15,000

Total Allowance dollars to be carried in the Contractor's lump sum base bid price: $ 17,500

TIME OF COMPLETION:

The undersigned agrees to substantially complete the project within 120 calendar days after authorized to proceed.

The undersigned also agrees to totally complete (final completion) the project within 60 days after the date of substantial completion.

In the event that project is uncompleted at the expiration of these periods, liquidated damages of $1000 per calendar day shall be assessed against the Contractor for each calendar day in excess of the periods of time allotted.

REQUIREMENT FOR LICENSE NUMBER

In compliance with the requirements of the Rhode Island General Laws, Section 5-65-23, my Rhode Island license number for the work to be performed by this firm as a prime contractor is:

License Number: _____

ADDITIONAL PROPOSAL PROVISIONS:

In submitting this Bid, the undersigned agrees:

To the allowance percentages for overhead and profit as indicated in the Supplementary Conditions.

To accept the provisions of the Bidding Requirements.

To accept the provisions of the Contract Documents, as defined by Article 1.1.1 of the General Conditions.

To execute a Contract in the form stipulated, within eight (8) calendar days after the receipt of acceptance of this Bid, provided such acceptance is mailed, telegraphed, telephoned or delivered to the undersigned within the time stipulated in the Instructions to Bidders.

MISCELLANEOUS PROVISIONS:

In addition to the foregoing, the undersigned:

Has acknowledged receipt of all Addenda by inserting the number of the last Addendum in the first paragraph herein.

Has enclosed herewith the required bid security and a properly executed Letter of Intent, which requires the undersigned to execute the Bond prior to the start of any work.

Declares that this proposal in all respects is fair and made without collusion with any other person, firm or corporation making a proposal for this work.

Designates as his Office to which such notice of acceptance may be mailed, telegraphed or delivered:

Address: _____

_____

Bidder
Name:_____

BY: Signature: _____ DATE: _____

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Type or print Name: _____ TITLE: _____

ADDRESS: _____

_____

If a corporation, give the State of incorporation using the phrase "a corporation organized under the laws of

_____."

If a partnership, give names of partners using also the phrase "co-partners trading and doing business under the firm name and style of

_____."

If an individual using a trade name, give individual name, using also the phrase "an individual doing business under the trade name and style of

_____."

END OF SECTION 00 04 10

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SECTION 00 80 00 - SUPPLEMENTARY CONDITIONS

A. INTRODUCTION

The following supplements modify the "General Conditions of the Contract for Construction", AIA Document A201-2007. Where a portion of the General Conditions is modified or deleted by the Supplementary Conditions, the unaltered portions shall remain in effect.

B. OTHER CONDITIONS

Should additional conditions be required for the work of this Project, they shall be included in that portion of this Project Manual directly following these Supplementary Conditions; and with their inclusion become a part of the Contract for this work.

C. REFERENCE TO DIVISION 1

Where provisions of the General Conditions relate to project administrative or work-related requirements of the Contract, those paragraphs are may have additional Requirements or Conditions, specified in Division 1, "General Requirements" of the Specifications.

ARTICLE 1 - GENERAL PROVISIONS

Add the following sub-paragraphs to 1.1:

1.1.9 Miscellaneous Definitions.

1.1.9.1 The term "product" includes materials, systems and equipment.

1.1.9.2 Where "as shown", "as indicated", "as detailed", or words of similar import are used, it shall be understood that references to the drawings accompanying this specification is made, unless otherwise stated. Where "as directed", "as required", "as permitted", "approved", "acceptance", or words of similar import are used, it shall be understood that the direction, requirement, permission, approval or acceptance of the Architect is intended, unless stated otherwise. As used herein, "provide" shall be understood to mean "provide complete in place" that is, "furnish and install".

Add the following Paragraph 1.7:

1.7 AVAILABILITY OF CADD DRAWING FILES

1.7.1 After award and upon request, the electronic "Computer-Aided Drafting and Design (CADD)" drawing files will be made available to the Contractor for his/her/their use in preparation of his/her/their construction coordination and shop drawings related to the referenced contract, and subject to the following terms and conditions. Coordinate with Section 013000 - SUBMITTALS of the Project Manual.

1.7.1.1 The files and/or disk(s) may contain information submitted, in part, by others. While this information is believed to be reliable, there may be occasional inconsistencies due to the transfer of electronic data from our master file to the disk(s), as well as in the transfer of disk data to your system. Thus, RGB is not responsible for its accuracy, or for errors or omissions, which may have been incorporated into the resultant documents, nor does it make any warranties, expressed or implied, of merchantability or for fitness for a particular purpose.

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1.7.1.2 Data contained on these electronic files shall not be used for any purpose other than as a convenience in coordination of the work and the preparation of the shop drawings for the referenced project.

1.7.1.3 Any other use, without the express written permission of the Architect, shall be at the sole risk of the Contractor and without liability or legal exposure to the Architect.

1.7.1.4 The Contractor shall make no claim and waives to the fullest extent permitted by law, any claim or cause of action of any nature against the Architect, its agents or sub consultants that may arise out of, or in connection with, the Contractor's or his agent's use of these electronic files. By opening the files, the Contractor shall, to the fullest extent permitted by law, agrees to fully indemnify and hold the Architect and his consultants harmless against all damages, liabilities or costs, including reasonable attorney's fees and defense costs, arising out of or resulting from the use of these electronic files.

1.7.1.5 These electronic CADD drawing files are not construction documents. Differences may exist between the CADD files and the corresponding construction documents. The Architect makes no representation regarding the accuracy or completeness of the electronic CADD files, nor does it make representation to the compatibility of these files with the Contractors hardware or software.

1.7.1.6 In the event that a conflict arises between the signed and sealed construction documents prepared by the Architect and the furnished CADD files, the signed and sealed construction documents shall govern.

1.7.1.7 The Contractor is responsible for determining if any conflict exists. Use of these CADD files does not relieve the Contractor of his contractual obligations and requirement to fully comply with all the contract documents, including and without limitation, the need to check, confirm and coordinate the work of all contractors, suppliers, and agents for the project.

1.7.1.8 If the Contractor uses, duplicates and/or modifies these electronic CADD files for use in producing shop drawings, coordination drawings, and data related to this contract, all previous indication of ownership (seals, logos, signatures, initials, and dates) shall be removed.

1.7.1.9 These files shall be made available at the cost of $ $500.00 per CD or website transfer. Make Checks payable to the Architect. Payment is due at the time of delivery of files.

1.7.1.9.1 Files will be made available on CD-ROM or ftp website only. No documents will be e-mailed.

ARTICLE 2 - OWNER

2.2 INFORMATION AND SERVICES REQUIRED OF THE OWNER

2.2.5 Change to read:

"Prior to the start of construction, the Contractor will be furnished, free of charge, 1 set of PDF files of the Drawings and Project Manual, complete with Addendum, for his use in the execution of the Contract. Additional sets as may be required, by the Contractor, shall be procured by the Contractor at his costs. The Contractor shall print and utilize one of these sets of documents for the sole purpose of maintaining "record documents".

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ARTICLE 3 - CONTRACTOR

3.2 REVIEW OF CONTRACT DOCUMENTS AND FIELD CONDITIONS BY CONTRACTOR

Add the following sub-paragraphs to 3.2:

3.2.5 In case of an inconsistency between Drawings and Specifications or within either Document not clarified by addendum, provide the better quality or greater quantity of Work in accordance with the Architect's interpretation.

3.2.6 Omissions from the drawings and specifications of items obviously needed to perform the work, such as attachments, bolts, hangers, and other fastening devices shall not relieve the Contractor from furnishing and installing same. It shall be the duty of the Contractor to procure from the Architect all necessary interpretations of the designs, drawings and specifications.

3.4 LABOR AND MATERIALS

Add the following sub-paragraph 3.4.0:

3.4.0 Refer to Specification Section entitled, SUMMARY OF THE WORK, for additional provisions on the subject. References to Section 3.4 elsewhere in the Contract Documents shall also read as referring to that Section of the Specifications.

3.6 TAXES

Add the following sub-paragraph 3.6.0:

3.6.0 Refer to Specification Section entitled, SUMMARY OF THE WORK, for additional provisions on the subject. References to Section 3.6 elsewhere in the Contract Documents shall also read as referring to that Section of the Specifications.

3.7 PERMITS, FEES, NOTICES, AND COMPLIANCE WITH LAWS

Add the following sub-paragraph 3.7.0:

3.7.0 Refer to Specification Section entitled, SUMMARY OF THE WORK, for additional provisions on the subject. References to Section 3.7 elsewhere in the Contract Documents shall also read as referring to that Section of the Specifications.

3.8 ALLOWANCES

Add the following sub-paragraph 3.8.0:

3.8.0 Refer to Specification Section entitled, ALLOWANCES, for additional provisions on the subject. References to Section 3.8 elsewhere in the Contract Documents shall also read as referring to that Section of the Specifications.

3.9 SUPERINTENDENT

Add the following sub-paragraph to 3.9.2

3.9.2.1 Employ a project superintendent acceptable to the Owner and Architect. Prior to the assignment or replacement of a superintendent, submit a resume to the Architect for acceptance review.

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3.10 CONTRACTOR'S CONSTRUCTION SCHEDULES

Refer to Specification Section entitled, CONSTRUCTION PROGRESS DOCUMENTATION, for additional provisions on the subject. References to Section 3.10 elsewhere in the Contract Documents shall also read as referring to that Section of the Specifications.

3.11 DOCUMENTS AND SAMPLES AT THE SITE

Add the following sub-paragraph 3.11.0

3.11.0 Refer to Specification Section entitled, SUMMARY OF THE WORK, for additional provisions on the subject. References to Section 3.11 elsewhere in the Contract Documents shall also read as referring to that Section of the Specifications.

3.12 SHOP DRAWINGS, PRODUCT DATA AND SAMPLES

Add the following sub-paragraph 3.12.0

3.12.0 Refer to Specification Section entitled, SUBMITTALS, for additional provisions on the subject. References to Section 3.12 elsewhere in the Contract Documents shall also read as referring to that Section of the Specifications.

3.13 USE OF SITE

Add the following sub-paragraph 3.13.0

3.13.0 Refer to Specification Section entitled, SUMMARY OF THE WORK, for additional provisions on the subject. References to Section 3.13 elsewhere in the Contract Documents shall also read as referring to that Section of the Specifications.

3.14 CUTTING AND PATCHING

Add the following sub-paragraph 3.14.0

3.14.0 Refer to Specification Section entitled, SUMMARY OF THE WORK, for additional provisions on the subject. References to Section 3.14 elsewhere in the Contract Documents shall also read as referring to that Section of the Specifications.

3.15 CLEANING UP

Add the following sub-paragraph 3.15.0

3.15.0 Refer to Specification Section entitled, CLEANING and Specification Section entitled CLOSEOUT PROCEDUES for additional provisions on the subject. References to Section 3.15 elsewhere in the Contract Documents shall also read as referring to those Sections of the Specifications.

ARTICLE 7 - CHANGES IN THE WORK

7.1 GENERAL

Add new sub-paragraphs:

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7.1.4 The amount of credit to be allowed by the Contractor to the Owner for any deletion or change which results in a net decrease in the Contract Sum will be the amount of the actual net cost as confirmed by the Architect. When both additions and credits covering related Work or substitutions are involved in any one change, the allowance for overhead and profit shall be figured on the basis of the net increase, if any, with respect to that change.

7.1.5 The reasonable (as stated herein) allowance for overhead and profit combined, included in the total cost to the Owner, shall be based upon the following schedule:

7.1.5.1 For the Contractor, for any work performed by his own forces, 10% of the cost;

7.1.5.2 For each Sub-Contractor involved, work performed by his own forces, 10% of the cost;

7.1.5.3 For the Contractor, for work performed by his sub-contractor, 5% of the amount due the sub-contractor.

7.1.6 Subsequent to the approval of a Change Order, whether involving a change in Contract Sum, contract time or both, no additional claim related to that matter will be considered by the Owner. A change incorporated into a Change Order is therefore, all inclusive, and includes such factors as project impact, schedule "ripple" effect or other items which may pertain to such change.

ARTICLE 8 - TIME

8.3 DELAYS AND EXTENSIONS OF TIME

Add new sub-paragraphs:

8.3.4 Landscape work and corresponding seasonally limited work may be scheduled for later completion, as mutually agreed upon, and completed under approved working conditions.

8.3.5 When designated by the Architect, additional time of one month will be allowed for the principal purpose of removing materials and equipment from the site and for the final cleaning up operations of the site work.

ARTICLE 9 - PAYMENTS AND COMPLETION

9.2 SCHEDULE OF VALUES.

Add the following sub-paragraph 9.2.1:

9.2.1 Refer to Specification Section entitled, PAYMENT PROCEDURES, for additional provisions on the subject. References to Section 9.2 elsewhere in the Contract Documents shall also read as referring to that Section of the Specifications.

9.3 APPLICATIONS FOR PAYMENT

9.3.1 Add the following sentence:

“The form of Application for Payment shall be AIA Document G702, APPLICATION AND CERTIFICATION FOR PAYMENT, supported by AIA Document G702A, Continuation Sheet. Prior to the submission of the completed (typed) application, submit a draft copy for review by the Architect.”

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9.4 CERTIFICATES FOR PAYMENT

Add new sub-paragraphs:

9.4.3 First Certificate for Payment - The Architect will process this Certificate, only after he has received (1) the information required of Article 7 of the Instructions to Bidders, (2) Certification that the Contractor is currently maintaining Record Drawings, (3) decisions on options indicated in Section 010100 (if any), (4) submissions required in Section 013000, and (5) is adhering to the requirements of Article 3 of the General Conditions and Supplementary Conditions.

9.4.4 Second and Subsequent Certificates for Payment - The Architect will process the second certificate only after receipt of (1) Certificates that contractor is currently maintaining record drawings, (2) Release of Liens, (3) Certification of foundation and building layout survey data if specified in Section 010100, and (4) all proposed materials and color samples have been submitted for Architect's approval and color selections. Certification as to maintenance of Record Drawings and Releases of Lien will accompany subsequent applications, otherwise the Architect will not process the respective Certificate for Payment.

9.6 PROGRESS PAYMENTS

Add the following to sub-paragraph to 9.6.1:

9.6.1.1 The Owner shall make payments on account of this Contract as provided herein as follows: On or about the 15th day of each month, 90 percent of the value, based on the Contract prices for labor and materials incorporated in the work and of materials suitably stored at the site thereof or at some other location agreed upon, in writing, by the parties up to the first day of that month, as estimated by the Architect, less the aggregate of previous payments; and upon substantial completion of the entire work, a sum sufficient to increase the total payments to 95% of the Contract Price.

9.6.1.2 Such reduction shall occur upon the Owner's approval and after receipt of AIA Document G707A (Consent of Surety to Reduction).

9.8 SUBSTANTIAL COMPLETION

Add the following to sub paragraph 9.8.1:

9.8.1.1 “Prior to issuance of a Certificate of Substantial Completion, and in addition to the requirements herein, the Contractor and his sub-contractors shall submit: (1) their respective certificates of contract document compliance; (2) warranties and guarantees; (3) bonds; (4) certificates and affidavits; (5) operating manuals, report of Owner instructions and test results; (6) project record documents, including record drawings; (7) extra materials and samples (as specified) required for Owner; and (8) Occupancy Permit, if required.”

9.10 FINAL COMPLETION AND FINAL PAYMENT

Add the following to sub paragraph 9.10.1:

“Prior to final inspection, and in addition to the requirements herein, submit: (1) Contractor's Affidavits (AIA Document G706 and G706A); and Consent of Surety (AIA Document G707).”

Add new Paragraphs:

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9.11 RELEASES OF LIEN

9.11.1 The Contractor shall submit Releases of Lien from all sub-contractors and material suppliers indicating payment(s) received from the previous applications. Certificates for Payment will not be processed unless these releases are included therewith.

9.11.2 Immediately satisfy any lien or encumbrance which, because of any act or default of the Contractor is filed against the premises, and indemnify and save the Owner harmless against all resulting loss and expenses, including attorney's fees. In addition, moneys due under this Contract, as may be considered necessary by the Owner, may be retained by the Owner until all such suits, claims for damages or expenses as aforesaid shall been settled and paid.

9.11.3 The statement on the Standard AIA Form G702, Certificate for Payment, which certifies that "all bills are paid for which previous certificates for payment were issued" shall be notarized by a Notary Public currently licensed to practice in the State in which the Project is located.

9.12 LIQUIDATED DAMAGES.

9.12.1 The Owner will suffer financial loss if the Project is not completed (Substantial and Final) on the dates set forth in the Contract Documents. The Contractor (and his Surety) shall be liable for and shall pay to the Owner the sums stipulated in the Bid Form as fixed, agreed, and liquidated damages for each calendar day of delay until the Work is Completed.

ARTICLE 11 - INSURANCE AND BONDS

11.1 CONTRACTOR'S LIABILITY INSURANCE

Add new sub-paragraph under 11.1.1:

11.1.1.9 Liability insurance shall include all major divisions of coverage and be on a comprehensive general liability basis including:

Premises-Operations (including (X-C-U)
Independent contractor's protective
Blanket contractual
Owned, non-owned and hired motor vehicles
Broad form property coverage (including explosion, collapse and underground)

Add the following sub-paragraph to 11.1.2:

11.1.2.1 The insurance required by sub-paragraph 11.1.1 shall be written for not less than the following, or greater if required by law:

Worker's Compensation:

State and Federal (where applicable) - Statutory
Employer's Liability - $500,000.

Comprehensive General Liability (including Premises-Operation; Independent Contractors' Protective; Products and Completed Operations; Broad Form Property Damages; Contractual and Personal Injury)

Bodily Injury/Property Damage:

$1,000,000. - Each Occurrence

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$2,000,000. - Annual Aggregate

Products and Completed Operations to be maintained for two (2) years after final payment.

Property Damage Liability Insurance will provide X, C or U coverage as applicable.

Comprehensive Automobile Liability:

Bodily Injury/Property Damage:

$1,000,000. - Each Occurrence

Add the following sub-paragraph to 11.1.3:

11.1.3.1 The Contractor shall furnish one copy each of Certificates of Insurance, acceptable to the Owner, herein required for each copy of the Agreement which shall be specifically set forth evidence of all coverage required by sub-paragraphs 11.1.1, 11.1.2 and 11.1.3. The form of the Certificate shall be acceptable to the Owner. The Contractor shall furnish to the Owner copies of any endorsements that are subsequently issued amending coverage or limits.

11.2 OWNER'S LIABILITY INSURANCE

Change paragraph 11.2. to read:

11.2. The Contractor shall furnish the Owner, through the Architect, an insurance certificate providing Owner's Protective Liability extended to include the interests of the Architect, and to protect the Owner and the Architect, The Robinson Green Beretta Corporation, from any liability which might be incurred against them as result of any operation of the Contractor or his sub-contractors or their employees. Such insurance shall be written for the same limits as the Contractor's Liability Insurance, and shall include the same coverage.

11.3 PROPERTY INSURANCE.

Change sub-paragraph 11.3.1 to read:

11.3.1 The Contractor shall purchase and maintain property insurance upon the entire Work at the site to the full insurable value thereof. Such insurance shall be in a company or companies against which the Owner has no reasonable objection. This insurance company shall include the interests of the Owner, the Contractor, Sub-contractors and Sub-subcontractors in the Work and shall insure against the perils of fire and extended coverage and shall include "all risk" insurance for physical loss or damage including, without duplication of coverage, theft, vandalism, and malicious mischief. If not covered under all risk insurance or otherwise provided in the Contract Documents, the Contractor shall effect and maintain similar property insurance on portions of the Work stored off the site or in transit when such portions of the Work are to be included in an application for Payment under Sub-paragraph 9.3.2.

11.3.1.1 The form of policy for this coverage shall be completed value.

11.3.1.2 If by the terms of this insurance any mandatory deductibles are required, or if the Contractor should elect, with concurrence of the Owner, to increase the mandatory deductible amounts, the Contractor shall be responsible for payment of the amount of the deductible in the event of a paid claim.

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11.3.4 Delete this sub-paragraph in its entirety.

Change sub-paragraph 11.3.6 to read:

11.3.6 Before an exposure to loss may occur, the Contractor shall file with the Owner two certified copies of the policy or policies providing this Property Insurance coverage, each containing those endorsements specifically related to the Project. Each policy shall contain a provision that the policy will not be canceled or allowed to expire until at least thirty (30) days' prior written notice has been given to the Contractor.

ARTICLE 12 – UNCOVERING AND CORRECTION OF WORK

12.2 CORRECTION OF WORK

12.2.2. AFTER SUBSTANTIAL COMPLETION

Change sub-paragraphs under 12.2.2 to read:

12.2.2.1 Change all references of ‘one year’ to read ‘two years’ and ‘one-year’ to read ‘two-years’

12.2.2.2 Change all references of ‘one-year’ to read ‘two-years’

12.2.2.3 Change all references of ‘one-year’ to read ‘two-years’

ARTICLE 13 - MISCELLANEOUS PROVISIONS

13.5 TESTS AND INSPECTIONS

Add the following sub-paragraph to 13.5.1

13.5.1.1 Refer to Specification Section 01 40 00 for the extent of other inspection and testing services to be included as part of this Contract.

Add the new paragraph 13.8:

13.8 SPECIAL WARRANTIES

13.8.1 The Contractor shall provide and pay for all the requirements outlined in this section (13.8) as part of the Project Base Bid.

13.8.2 Service Contracts will be captured in the Project Schedule of Values. The costs associated with the Service Contract Work will not be subject to Retainage and will be billed quarterly for the duration of the Service Contract period, unless otherwise approved in writing by the Owner.

13.8.3 Warranty Provisions:

13.8.3.1 As prescribed in Paragraph 12.2.2.1 of AIA Document A201- 2007 as amended by the Contract Agreement the Contractor shall provide a minimum of a two (2) year warranty period on all systems, repairs, materials and workmanship incorporated in the project. Systems, repairs, materials and workmanship that has been prescribed as having warranties for periods greater than two (2) years by the individual specification sections shall be carried at the warranty period prescribed by that individual reference provided a minimum of two (2) years are provided in all aspects of the warranty/guarantee provisions.

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13.8.3.2 Additionally, as prescribed in 12.2.2.2 of AIA Document A201-2007 as amended by the Contract Agreement, the two (2) year period for correction of work shall be extended with respect to portions of Work first performed after Substantial Completion by the period of time between Substantial Completion and the actual performance of Work.

13.8.3.3 Additionally as provided in 12.2.2.3 of AIA Document A201-2007 as amended by the Contract Agreement states upon completion of any Work under or pursuant to Paragraph 12.2 that the two (2) year correction period in connection with the Work requiring correction shall be renewed and recommence. The obligations under Paragraph 12.2 shall cover any repairs and replacement to any part of the Work or other property that is damaged by the defective Work and Work impacted by such corrective action.

Add the following ARTICLE 16:

ARTICLE 16 - EQUAL OPPORTUNITY

16.1 THE CONTRACTOR POLICIES OF EMPLOYMENT

16.1.1 The Contractor shall maintain policies of employment as follows:

16.1.1.1 The Contractor and all Sub-contractors shall not discriminate against any employee or applicant for employment because of race, religion, color, sex, national origin or age. The Contractor shall take affirmative action to insure that applicants are employed, and that employees are treated during employment without regard to their race, religion, color, sex, national origin or age. Such action shall include, but not be limited to the following: employment, upgrading, demotion or transfer; recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship. The Contractor agrees to post in conspicuous places, available to employees and applicants for employment, notices setting forth the policies of non-discrimination.

16.1.1.2 The Contractor and all Sub-contractors shall, in all solicitations or advertisements for employees placed by them on their behalf, state that all qualified applicants will receive consideration for employment without regard to race, religion, color, sex, national origin or age.

END OF SECTION 00 80 00

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Asbestos Abatement Plan
Rhode Island Army National Guard
Warwick Armory Building #1
ECM #170319B

Prepared for:
RI National Guard
Facilities & Maintenance
Ms. Ann Marie Ethier

Prepared by:

ECM Environmental Consulting & Management

July 2017

RHODE ISLAND DEPARTMENT OF HEALTH

NOTARIZED CERTIFICATION OF ASBESTOS AMENDED ABATEMENT PLAN

Facility: **RI Army National Guard – Warwick Armory – Bldg 1**

Address: **541 Airport Road**

City/Town: **Warwick, RI** Zip: **02886** Amendment Phase No:

Abatement Plan Written By: **Daniel J. Simas** Certification No: **AAC-0567**

Summary of specific waivers/variances being requested: **see Attachment #4**

Type of Asbestos Abatement (**X**) Removal ( ) Enclosure ( ) Encapsulation
( ) Demolition ( ) Glovebag ( ) Asphalt Roofing
( ) Other (specify) _____

Is this plan being submitted in response to a Notice of Violation and/or a Notice of Requirement to Submit an Asbestos Abatement Plan? ( ) Yes (**X**) No

If yes, Indicate Notice/Building Evaluation No(s):

Contractor: **To be determined** License No:

Estimated Starting Date: **07/21/17**

Pre-Abatement Sampling Information

Bulk Samples Collected By: **Colin Hannagan** Certification No: **AAC-0931**

Bulk Samples Analyzed By: **SanAir** Certification No: **AAL-0143**

Air Samples Analyzed By: **Colin Hannagan** Certification No: **AAL-0931**

Clearance Air Sampling Information

Air Samples to be Collected By: **ECM Inc. Personal**

Air Samples to be Analyzed By: **ECM Inc.** Certification No: **AAL-131**

CERTIFICATION

I certify that: this asbestos abatement plan is prepared and submitted under the provisions of Section 23-24.5-6 of the RI Asbestos Control Act and Parts A and C of the RI Rules and Regulations for Asbestos Control; all abatement/management activities performed in conjunction with this plan must be in compliance with the specifications prescribed in this plan (when approved) and the most current revision of all applicable federal and state regulations; and the asbestos abatement/management activities described in this plan must be performed by a RI licensed asbestos abatement contractor.

Certified by: _____ Title: _____
(Signature of Building Owner or Agent)

_____ Date: _____
(Typed/Printed Name of Certifier)

Subscribed and sworn before me this _____ day of _____, 20_____

_____ My Commission Expires: _____
(Notary Public)

AFFIX NOTARY SEAL HERE

STATE OF RHODE ISLAND AND PROVIDENCE PLANTATIONS
Department of Health
Office of Occupational & Radiological Health

APPLICATION FOR APPROVAL OF AN ASBESTOS ABATEMENT PLAN

1. Building Owner's Name:
   RI Army National Guard

2. Application Prepared By:
   Daniel J. Simas
   RI certification No: **AAC-0567**
   Telephone No: **401-304-6612**

3. Building Owner's Mailing Address and Telephone Number:

   Street: **645 New London Avenue**

   City/Town: **Cranston**

   Zip: **02920**

   Telephone No.: **401-275-4189**
   (Area Code, No., Ext.)

4. Person to be contacted regarding this application:

   Name: **Ms. Ann Marie Ethier**

   Telephone No: **401-275-4189**
   (Area Code, No., Ext.)

5. Location where abatement work will be performed:

   Name (if applicable): **Warwick Armory – Bldg 1**
   Street: **541 Airport Road**
   City/Town: **Warwick** Zip: **02886**

6. Is this application being submitted in response to a "Notice of Requirement to Submit an Asbestos Abatement plan"? ( ) Yes (**X**) No

If Yes, what is the due date for submittal of Abatement plan? _____
(Mo.) (Day) (Yr.)

Evaluation Number on the Notice: _____

7. Contractor who will be performing abatement work (if selected):

   Name: **To be determined** R.I. License No.:

8. Estimated Starting Date of Abatement Work **07** (Month) **21** (Day) **2017** (Year)

9. Estimated Completion Date of Abatement Work: **11** (Month) **01** (Day) **2017** (Year)

10. Type of Asbestos Abatement: **(Check all that apply)**

(**X**) Removal
( ) Encapsulation
( ) Operations and Maintenance Only
( ) Enclosure
( ) Demolition
( ) Asphalt Roofing

11. Type of Building:

( ) School
(**X**) Privately Owned Building
( ) Publicly Owned Building
( ) Residence
( ) Other (Specify) _____

12. Building Access:

( ) Public Access (≥ 25% of Building Area)
(**X**) Limited Public Access (< 25% of Building Area)
( ) No Public Access

13. Bulk Sample Collection and Analysis:

A). Person collecting bulk samples:

Name: **Colin Hannagan** RI Certification No.: **AAC-0931**

B). Sampling Methodology:

(**X**) EPA AHERA Sampling requirements [40 CFR 763.86].

( ) EPA's Asbestos Containing Material in School Buildings: A Guidance Document (EPA-405/2-78-014) or Guidance for Controlling Asbestos Containing Materials – 1985 Edition (EPA-560-5-85-024)

( ) Other (Specify) _____

C). Laboratory performing the analysis of the bulk samples

Name: **SanAir** RI Certification No.: **AAL-0143**

D). Analytical Methodology:

(**X**) EPA Interim Method for the Determination of Asbestos in Bulk Insulation Samples [PLM method only].

( ) Other (Specify) _____

14. Pre-Abatement Air Sample Collection and Analysis:

A). Person collecting pre-abatement air samples:

Name: **Colin Hannagan** Affiliation: **ECM Inc.**

B). Laboratory performing analysis of pre-abatement air samples.
Name: **ECM Inc** RI Certification No.: **AAL-131**

C). Methodology used in the collection and analysis of pre-abatement samples:

(**X**) NIOSH Method 7400 [Most Current Revision]

( ) OSHA 29 CFR 1926.1101 – Appendix A & B

( ) Other (Specify)

---

15. A. Indicate how the regulated asbestos containing material (RACM) will be removed from the abatement site. If a hauler or broker will be used to transport the RACM to a disposal site, they must also be identified.

To be determined_____

B. Provide the name and location of the authorized asbestos waste facility to which the removed material will be transferred for disposal (if known).

To be determined_____

---

16. Person designated as compliance monitor for abatement work. **[NOT REQUIRED]**

Name: **ECM Inc. Personnel**

Affiliation: **Environmental Consulting and Management Inc. (ECM Inc.)**

17. In-Process & Clearance Air Sampling: **See Attachment #1**

    A. Describe on an attachment the type, number and location of air samples that will be collected outside the work area during the abatement project.

    B. Describe on an attachment the plan of action to be followed if the Indoor Non-Occupational Air Exposure Standard for Asbestos (0.01 fibers per cubic centimeter) is exceeded outside the work area during the abatement project.

    C. Describe on an attachment the type, number and location of air samples that will be collected as part of the final clearance testing.

    D. Describe on an attachment the plan of action to be followed if the Indoor Non-Occupational Air Exposure Standard for Asbestos (0.01 fiber per cubic centimeter) is exceed during final clearance testing.

---

18. A separate and fully completed Form ASB-16A must be submitted for each area to be abated. List below the entry in Item 1 from each attached ASB-16A.

    Area 1 – Northern Men's + Women's Latrines
    Area 2 – Central Latrines and office space

---

19. I certify that this plan was prepared by me and I am responsible for its content.

    Signature: _____ Date _____7/7/2017_____
    (Month) (Day) (Year)

    Affiliation: **Environmental Consulting & Management, Inc.**

---

20. ASBESTOS ABATEMENT PLAN APPLICATION FEE:

( ) Operation & Maintenance Only	$ 75
( ) Up to One (1) NESHAP Unit	$ 75
( ) Between One (1) & Ten (10) NESHAP Units	$ 300
( ) Between Ten (10) & Fifty (50) NESHAP Units	$ 600
( ) Over Fifty (50) NESHAP Units	$ 900
( ) Amendment Fee	$ 150

(**X**) RI State Agency Waived Application Fee

STATE OF RHODE ISLAND AND PROVIDENCE PLANTATIONS

Department of Health

Office of Occupational & Radiological Health

APPLICATION FOR APPROVAL OF AN ASBESTOS ABATEMENT PLAN

SUPPLEMENTAL INFORMATION: AREA DESCRIPTION AND PROPOSED REMEDY

BUILDING LOCATION: **RI Army National Guard - Warwick Armory Building #1**

INSTRUCTIONS: All items on this form must be addressed. All references to attachments must be clearly identified. All attachments must be marked with the specific item numbers on this form to which they pertain.

---

(1) Area Location/Identification (Room Name/No., Evaluation Number, etc.):

Area 1 – Northern Men's/Women's Latrines

---

(2) Attach a description of each type (e.g. pipe, ceiling, etc.) of regulated asbestos containing material (RACM) in this area, including condition, location, quantity and asbestos content. Attach a copy of the laboratory report(s) for all samples. (NOTE: All laboratory reports must include the name of the building(s) and the location(s) of the sample(s).

Refer to Attachment #2

---

(3) Attach a current scale drawing of this area, showing direction of North and East, which has been clearly annotated to show the type, location and quantity of all RACM in this area. This drawing must include a legend which acts as a guide to the scale, symbols and nomenclature used in the drawing. If a master plan or multiple drawings are provided, indicate the specific location(s) and drawing number(s) which depict this area. The location of the decontamination chamber must also be so indicated on the appropriate drawing(s).

Refer to Attached Building Drawing

---

(4) PROPOSED REMEDIES:

A). Attach a description of the interim Operations and Maintenance Plan that will be implemented in accordance with C.1.2 (b).

Refer to Attachment #3

---

(4) PROPOSED REMEDIES (cont.):

B). Will any portion of this area be abated by use of B.8 work procedures?

(**X**) Yes ( ) No

If Yes, indicate below which RACM in this area will be abated by use of the following B.8 work procedures:

B.8.2 & B.8.3	[REMOVAL]	Mastic, Joint Compound
B.8.2 & B.8.4	[ENCAPSULATION]	_____
B.8.2 & B.8.5	[ENCLOSURE]	_____
B.8.6	[DEMOLITION]	_____
B.8.7	[GLOVEBAG]	_____
B.8.8	[ASP. ROOFING]	200 sf of Roofing

C). Are you requesting any waivers to the above selected B.8 procedure for any of the abatement activities in this area?

(**X**) Yes ( ) No **Waiver of wall poly and floor poly where mastic is present.**

If yes, attach a detailed description of the waivers requested you are proposing to utilize. All items must be keyed to the specific section(s) of the regulations for which waivers are requested.

D). Are you proposing alternative procedures under B.11 for any of the abatement activities in this area?

( ) Yes (**X**) No

If yes, attach a detailed description of the alternate procedures requested you are proposing to utilize. Alternate procedures must include a justification for not following specific section(s) of the regulations and be as protective of public health.

E). Will any RACM remain in this area after abatement?

( ) Yes ( ) No (**X**) Beyond scope of inspection

If Yes, attach a description of the RACM that will remain and the details of the on-going Operations and Maintenance Plan that will be implemented in accordance with C.1.2(b).

AGENCY USE ONLY

STATE OF RHODE ISLAND AND PROVIDENCE PLANTATIONS

Department of Health

Office of Occupational & Radiological Health

APPLICATION FOR APPROVAL OF AN ASBESTOS ABATEMENT PLAN

SUPPLEMENTAL INFORMATION: AREA DESCRIPTION AND PROPOSED REMEDY

BUILDING LOCATION: **RI Army National Guard - Warwick Armory Building #1**

INSTRUCTIONS: All items on this form must be addressed. All references to attachments must be clearly identified. All attachments must be marked with the specific item numbers on this form to which they pertain.

(5) Area Location/Identification (Room Name/No., Evaluation Number, etc.):

Area 2 – Central Latrines and office space

(6) Attach a description of each type (e.g. pipe, ceiling, etc.) of regulated asbestos containing material (RACM) in this area, including condition, location, quantity and asbestos content. Attach a copy of the laboratory report(s) for all samples. (NOTE: All laboratory reports must include the name of the building(s) and the location(s) of the sample(s).

Refer to Attachment #2

(7) Attach a current scale drawing of this area, showing direction of North and East, which has been clearly annotated to show the type, location and quantity of all RACM in this area. This drawing must include a legend which acts as a guide to the scale, symbols and nomenclature used in the drawing. If a master plan or multiple drawings are provided, indicate the specific location(s) and drawing number(s) which depict this area. The location of the decontamination chamber must also be so indicated on the appropriate drawing(s).

Refer to Attached Building Drawing

(8) PROPOSED REMEDIES:

F). Attach a description of the interim Operations and Maintenance Plan that will be implemented in accordance with C.1.2 (b).

Refer to Attachment #3

(4) PROPOSED REMEDIES (cont.):

G). Will any portion of this area be abated by use of B.8 work procedures?

(**X**) Yes ( ) No

If Yes, indicate below which RACM in this area will be abated by use of the following B.8 work procedures:

B.8.2 & B.8.3	[REMOVAL]	Mastic, Joint Compound and Pipe Insulation
B.8.2 & B.8.4	[ENCAPSULATION]	_____
B.8.2 & B.8.5	[ENCLOSURE]	_____
B.8.6	[DEMOLITION]	_____
B.8.7	[GLOVEBAG]	_____
B.8.8	[ASP. ROOFING]	_____

H). Are you requesting any waivers to the above selected B.8 procedure for any of the abatement activities in this area?

(**X**) Yes ( ) No **Waiver of wall poly and floor poly were mastic is present.**

If yes, attach a detailed description of the waivers requested you are proposing to utilize. All items must be keyed to the specific section(s) of the regulations for which waivers are requested.

I). Are you proposing alternative procedures under B.11 for any of the abatement activities in this area?

( ) Yes (**X**) No

If yes, attach a detailed description of the alternate procedures requested you are proposing to utilize. Alternate procedures must include a justification for not following specific section(s) of the regulations and be as protective of public health.

J). Will any RACM remain in this area after abatement?

( ) Yes ( ) No (**X**) Beyond scope of inspection

If Yes, attach a description of the RACM that will remain and the details of the on-going Operations and Maintenance Plan that will be implemented in accordance with C.1.2(b).

AGENCY USE ONLY

ATTACHMENT #1

In Process and Clearance Air Sampling

A. If requested by the building owner, ECM will be on site for part time monitoring and will collect one compliance air sample outside the containment area daily for the duration of asbestos removal operations inside this building. The sample will be collected outside the decontamination unit.

B. Any deviation in proper procedures on the part of the contractor shall be reported to the building owner. This includes inadequate paperwork on site, disagreement and/or any deviation from previously outlined work procedures, or if compliance samples in the work area vicinity exceed 0.01 f/cc. The contractor's work shall then be stopped, without repercussion to the building owner or the project-monitoring firm until any conflicts and/or problems have been resolved.

C. After the interior areas have passed the consultant's visual inspection, he or his authorized representative will collect the following air samples and the corresponding required blanks:

Area 1 and 2 – 2 PCM Clearance Air Samples will be collected within each containment under 2000 square feet and one additional PCM will be added per 1000 after.

D. If clearance monitoring after clean-up results in fiber concentrations in excess of the RI rules and regulation clearance air requirements, the project area shall be wet-cleaned, misted with water, and encapsulated with a liquid encapsulant. A period of no less than 24 hours shall elapse before the next set of clearance air samples can be collected. The sampling process shall be repeated until a satisfactory clearance air level is attained.

The asbestos contractor is held responsible for any costs associated with the re-cleaning and re-sampling of an area should clearance air samples exceed 0.01 f/cc.

ATTACHMENT #2

ASB-16A-2

Description of Asbestos Containing Material

<u>Area 1: Northern Latrines</u>

There is approximately 40 sf of mastic with non asbestos containing floor tile on the women's latrine landing. It should be assumed at this time that the mastic is present beneath the walls.

There is approximately 1200 sf of asbestos containing joint compound and associated drywall.

<u>Area 2: Central Latrines and Offices</u>

There is approximately 900 sf of mastic beneath 2x2 carpet tiles. Once the containment is constructed the carpet tiles will be removed. If the carpeting can be removed free from the asbestos containing mastic it can be disposed of as general construction debris. It should be assumed at this time that the mastic is present beneath the walls.

There is approximately 2400 square feet of asbestos containing joint compound and associated drywall.

It is the contractor's responsibility to verify all quantities.

ATTACHMENT #2 (Cont.)

Laboratory Analysis Reports:

1. Pre Abatement Air Samples
2. Bulk Samples

ATTACHMENT #3

Interim Operations & Maintenance Plan

The contractors associated with the Rhode Island National Guard are aware of the presence and location of ACBM within the above stated areas. They have been instructed not to disturb the material due to the potential health hazards if fibers become airborne.

1. Notification

All building occupants, also any contractors entering the building and/or premises to perform work, shall be notified of the presence and location of asbestos-containing material(s) and cautioned regarding disturbance of the material(s). Also, the building occupants must be notified regarding the occurrence of asbestos abatement activities. If an emergency fiber release occurs, the following procedures shall be initiated.

2. Fiber Release Episodes

A. Minor Release Episode

If a minor fiber release episode occurs (release of less than 10 linear feet or 25 square feet of material), trained maintenance staff may perform the cleaning. Access to the area shall be restricted during clean-up. All debris shall be thoroughly wetted using amended water and placed in labeled, double six-mil polyethylene bags. The area shall then be cleaned using HEPA filtered vacuums and/or wet cleaning methods. Damaged material must be cleaned and repaired with non-asbestos-containing material. The area shall then be evaluated to decide if further action is necessary.

B. Major Release Episode

If a major fiber release episode occurs (falling or dislodging of more than 10 linear feet or 25 square feet of ACBM), the cleaning must be carried out and directed by persons accredited to conduct and design response actions. After such an episode, the area shall be immediately restricted and entry to the area prevented. Warning signs shall be posted to caution people other than those qualified to deal with the problem. Air handling units in the area shall be shut down to prevent the spread of fibers beyond the problem area. A response action shall be designed and carried out by qualified personnel.

3. Training

Any employee who, because of their work, may disturb asbestos-containing material shall be trained and certified as a Competent Person as described by the RI Rules and Regulations for Asbestos Control. The program coordinator shall ensure that the procedures described above to protect the building occupants shall be followed for any operations and maintenance activities disturbing or involving ACBM.

ATTACHMENT #4

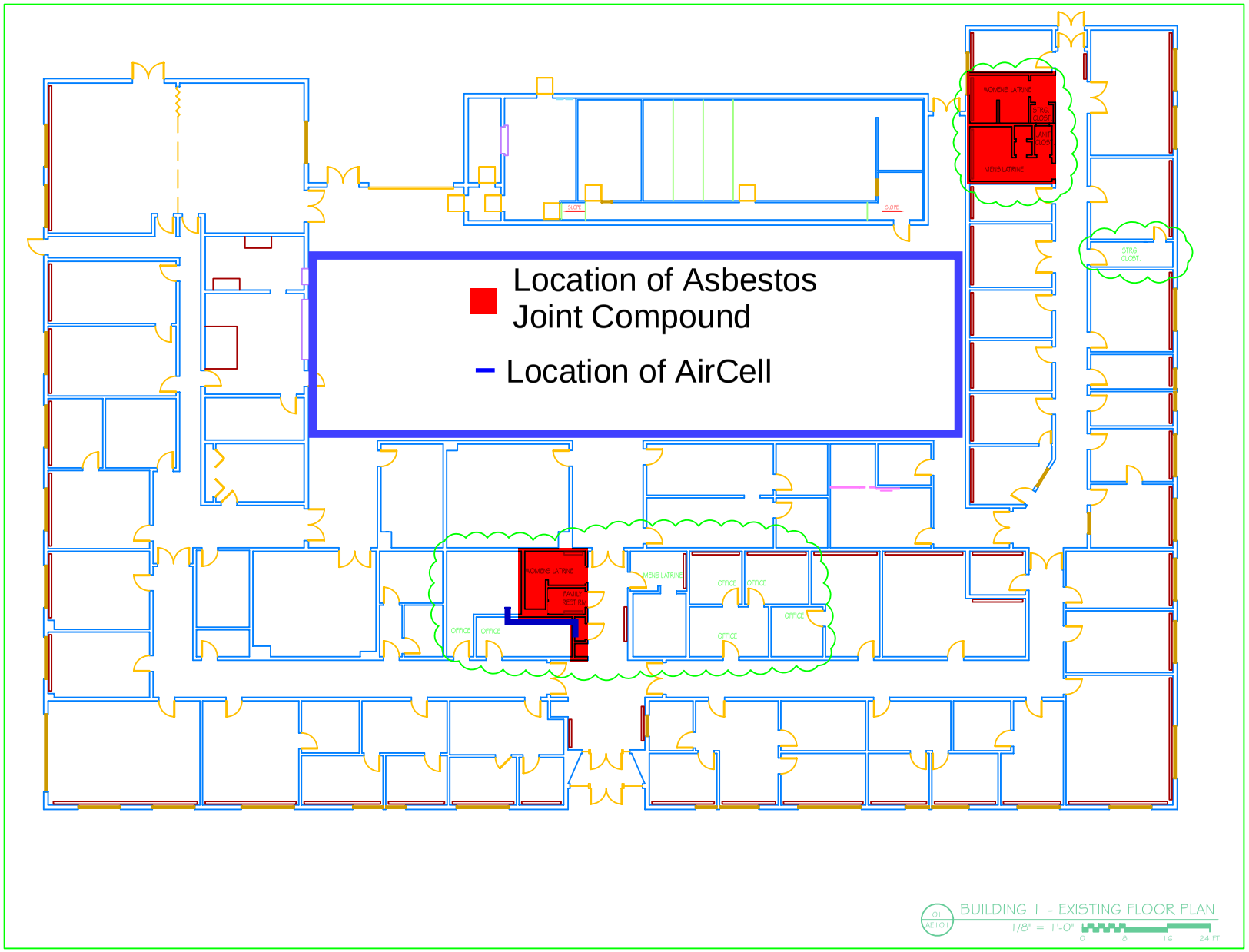
Scope of Work / Description of Waivers

It is the contractor's responsibility to verify material locations and quantities.

All proper OSHA, federal, state, and local safety regulations shall be followed.

Pipe insulation and fittings will be removed utilizing B8.7 work procedures.

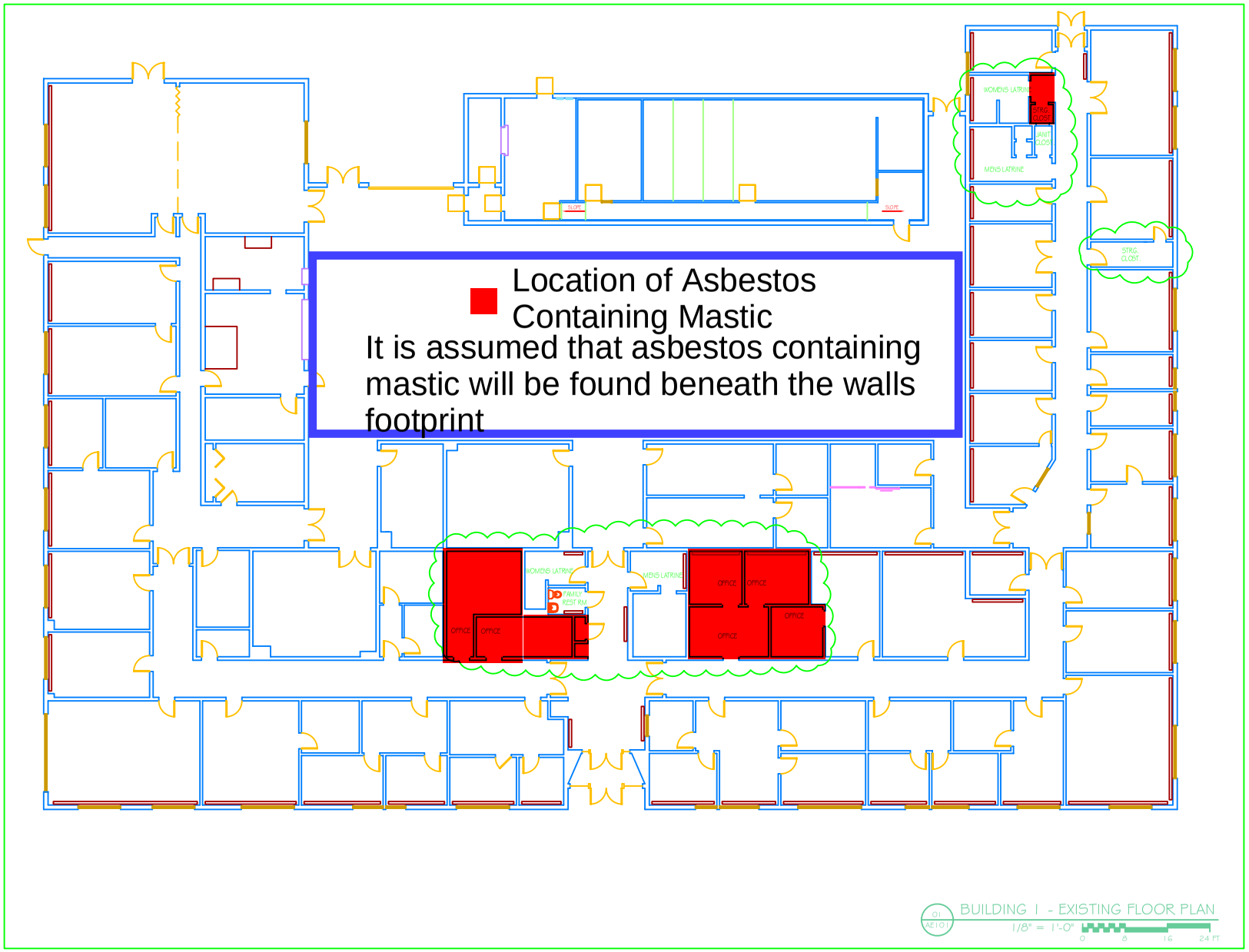
ECM requests a waiver of floor polyethylene sheeting during mastic abatement along with a waiver for wall polyethylene sheeting when abating the asbestos containing joint compound.



RIANG
Warwick Armory
Warwick Latrines

Asbestos
Abatement

Mandatory Site
Visit 4-11-2017



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SECTION 01 00 50 - GENERAL REQUIREMENTS AT EXISTING FACILITIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The General Conditions, Supplementary Conditions and applicable portions of Division 1 of the Specification are a part of this Section, which shall consist of all labor, materials, equipment, tools, construction equipment and machinery, water, heat, utilities, transportation and other facilities and services necessary for the proper execution and completion of the work, whether temporary or permanent and whether or not incorporated or to be incorporated in the work; and as related to the project or projects defined in the Bidding Requirements.

B. The specification format used herein is in accordance with MASTERFORMAT, CSI (2004 Format) and in no way intends to restrict this Contractor from expediting his work as he sees fit, nor is there any intention of segregating the units of work as related to specific trades involving jurisdictional problems.

1.2 CONTRACTOR'S DUTIES

A. The Contractor is responsible for all personnel involved in the work, including those of his direct employ, his sub-contractors and suppliers of materials and equipment and/or labor. The Technical Specifications have been divided for convenience only to cover the scope of work, and where reference to a particular contractor is noted, it is for convenience only. The Owner and Architect only recognize one Contractor as party to this Contract.

B. As it is impractical to enumerate every piece of equipment, device and/or accessory required for proper operation of the indicated systems specified within their respective Sections or Divisions of the Project Manual; it is intended that all materials, systems, and/or equipment, required to insure proper operation of the equipment, device, and/or accessory, be provided as a part of the Work of this Project so the specified work or system functions, and/or performs as required by the specification. To infer the intent is otherwise, is to render the specified work or system less than required.

C. Except as specifically noted, provide and pay for:

1. Labor, materials and equipment.
2. Tools, construction equipment and machinery.
3. Other facilities and services necessary for proper execution and completion of the Work.

D. Pay sales, consumer, use and similar taxes for the Work or portions thereof.

E. Secure and pay for, as necessary for proper execution and completion of the Work, and as applicable at time of receipt of Bids:

1. Permits.
2. Government fees.
3. Licenses.

F. Give required notices.

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G. Comply with codes, ordinances, rules, regulations, orders and other legal requirements of public authorities which bear on the performance of the Work.

H. Promptly submit written notice to the Architect of observed variance of Contract Documents from legal requirements.

I. Lay out all work and be responsible for all lines, elevations, measurements of the building, utilities and site work executed under the Contract. Verify the figures shown before laying out the Work and be responsible for any error resulting from failure to do so. Employ a competent registered engineer or registered land surveyor, approved by the Architect, for establishing all lines, levels and dimensions, and place at the disposal of the Architect, as required for checking purposes.

J. Enforce strict discipline and good order among employees. Do not employ persons not skilled in assigned task.

K. Notify all trades, sub-contractors and suppliers of all designated alternatives and be responsible for their coordination.

L. At your option, certain indicated materials and/or procedures are specified herein to be used in lieu of other indicated materials and/or procedures, at no change in Contract Price. Such options should be analyzed and coordinated during the bidding period, so that the selection of any may immediately be brought to the Architect's attention, once the Contract is awarded (within thirty days thereafter).

1.3 SCOPE OF THE WORK: Includes but is not limited to:

A. EXTERIOR:

1. Site drainage improvements.

2. Miscellaneous exterior wall infill and repair (including new EIFS).

3. Exterior doors, hardware and concrete pads at doors.

4. Painting of entire building.

B. INTERIOR:

1. Hazardous material (asbestos) abatement.
2. Selective demolition of interior walls, doors and frames, fixtures and finishes.
3. Demolition of existing mechanical, electrical and plumbing components.
4. Construction of new partition walls.
5. Finish walls, ceiling and flooring.
6. Mechanical system components and fixtures.
7. Electrical system components and fixtures.
8. Plumbing system components and fixtures.
9. Fire Alarm system components.

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1.4 SPECIAL CONDITIONS

A. The Contractor must schedule the Work, in the various rooms with the Owner, a minimum of seven days in advance.

B. The Owner will make available to the Contractor requested spaces, to be determined during the course of the Work. Upon substantial completion of the work in these areas and a minimal punch list, the Owner will make additional spaces available to the Contractor. Punch list completion must be scheduled to permit notification of tenants.

C. Miscellaneous work in other areas of the building must be scheduled seven (7) days in advance and approved by the Owner.

D. The Contractor is responsible to physically isolate all work areas, to protect residents, while maintaining safe egress.

E. The Contractor shall maintain a professional relationship with all tenants, employees and other occupants. All incidents with the residents must be promptly reported to the Owner or the Owner's Representative. The Owner will resolve all issues with all employees and other occupants.

F. Use of premises:
1. No storage of materials in the building. (Locate trailer in area designated by the Owner, and repair all damaged areas upon completion of the work.)
2. Provide office trailer and toilet facilities for work force. Do not use building facilities.
3. No smoking on the site or within the buildings.
4. Daily clean-up required.
5. Use of on-site utilities, electric and water permitted. Do not overtax existing systems.
6. Major movement of materials must be scheduled so as to minimize inconvenience of the tenants. Coordinate with the Owner.
7. Notify the Owner of utility interruptions a minimum of thirty-six (36) hours in advance.

G. Owner provided items/scope of work:
1. Lockers are to be provided by RIARNG.
2. Fire alarm work to be coordinated with RIARNG
3. Security requirements to be coordinated with RIARNG.

1.5 HEALTH AND SAFETY PRECAUTIONS

A. HAZARDOUS BUILDING MATERIALS:

1. Prior to commencing any removal or demolition operations, coordinate with the Owner/Operator to ensure that an asbestos survey has been conducted, in accordance with National Emission Standard for Hazardous Air Pollutants (NESHAP), 40 CFR, Part M, Section 61.145, of the Clean Air Act.
2. Notify the EPA prior to demolition/renovation operations in which more than 260 L.F. or 160 S.F. of regulated asbestos-containing material (RACM) is to be stripped or removed from facility components.
3. If during the course of the Work hazardous materials are encountered, or suspicion exists that such may be prevalent, including, but not limited to asbestos and/or lead paint, immediately and prior to any removal, contact the governing agency for testing and removal procedures.

B. OSHA:

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1. These construction documents, and the joint and several phases of construction hereby contemplated, are to be governed, at all times, by the applicable portions of the Federal Laws, including but not limited to, the latest amendments of the following:

   a. Williams-Steiger Occupational Safety and Health Act of 1970, Public Law 91-956;
   b. Part 1910 - Occupational Safety and Health Standards, Title 29, Code of Federal Regulations, as amended to date;

   c. Part 1926 - Safety and Health Regulations for Construction, Title 29, Code of Federal Regulations, as amended to date.

2. This Project, the Contractor and his sub-contractors shall, at all times, be governed by applicable Chapters of Title 29, Code of Federal Regulations, Part 1926 - Safety and Health Regulations for Construction, as amended to date.

   a. Note: Furnish the Owner and Architect copies of all accident reports.

C. Dig Safe:

1. All excavations near underground public utility facilities shall be performed in accordance with Connecticut State Law.

D. Emergencies:

1. Should tornado, hurricane, gale or heavy wind warnings be issued, take precautions to minimize the danger to persons, to the work, and to the adjacent property. Damage caused to any part of the work shall be rectified or replaced to the complete satisfaction of the Architect and at no expense to the Owner. Injury to personnel or damage to adjacent property because of the work shall be the complete responsibility of the Contractor, and he accepts exclusive responsibility for same.

E. Loading:

1. Do not load any part of the work involved in this Contract, during construction, with a load greater than it is calculated to carry with safety. Should any accidents or damage occur through any violation of this requirement, the Contractor shall be held responsible under his Contract and Bond. When, in the opinion of the Architect, portions of the structure appear to be overloaded, it shall be the Contractor's responsibility to prove otherwise, or the Contractor shall follow the instructions of the Architect in connection with reduction of the loads.

1.6 PROJECT RECORD DOCUMENTS

A. Maintain at job site, one copy of:

1. Contract Drawings.
2. Specifications.
3. Addenda.
4. Reviewed Shop Drawings.
5. Record Drawings.
6. Change Orders.
7. Other modifications to Contract.
8. Field Test Reports.
9. Approved materials, samples and colors.

B. Store documents in approved field construction office, apart from documents used for construction.

1. Provide files and racks for storage of documents.
2. File documents in accordance with Project Filing Format of MASTERFORMAT.
3. Maintain documents in clean, dry, legible condition.
4. Do not use record documents for construction purposes.
5. Make documents available at all times for inspection by Architect and Owner.

C. Recording changes:

1. Provide red pen or pencil for all marking.
2. Keep record documents current.
3. Do not permanently conceal any work until required information has been recorded.
4. Contract Drawings: Legibly mark to record actual construction and the following:

a. Record various elements of foundations in relation to lowest floor elevation.
b. Reference horizontal and vertical location of underground utilities and appurtenances to permanent surface improvements.
c. Reference location of internal utilities and appurtenances concealed in construction to visible and accessible features of structure.
d. Record field changes of dimensions and details.
e. Record changes made by Change Order or Field Order.
f. Record details not on original Contract Drawings.

5. Specifications and Addenda: Legibly mark up each Section to record the following:

a. Manufacturer, trade name, catalog number, and supplier of each product and item of equipment actually installed.
b. Changes made by Change Order and Field Order.
c. Other matters and materials not previously specified.

6. Shop Drawings: Maintain as record documents; legibly annotate drawings to record changes after review.

1.7 TRANSPORTATION AND HANDLING

A. Transport all materials and equipment on legally approved conveyances as required or recommended by the respective manufacturer or supplier.

B. Receive and handle all materials and equipment, at the project site, by conveyances or methods as recommended by the respective manufacturer or supplier.

C. Coordinate delivery of equipment and materials when two or more trades, contractors or suppliers are involved.

D. Remove from the site any material or item of equipment damaged during the transportation or handling process, and immediately replace at no additional cost to the Owner.

1.8 STORAGE AND PROTECTION

A. Store all materials and equipment as recommended by the respective manufacturer or supplier, including the following minimum requirements.

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B. Upon receipt of such materials and equipment, check, distribute, store and safeguard in a clean, dry, ventilated location.

C. Elevate off the ground, items which can be stored in exterior locations, and completely cover with approved tarpaulins. Protect against the elements at all times.

D. Maintain all storage areas in a clean and orderly condition at all times.

E. Immediately replace any material or item of equipment damaged, due to inadequate storage protection, at no additional cost to the Owner.

1.9 CUTTING AND PATCHING

A. Execute cutting, including excavating, fitting or patching work required to:

B. Make several parts fit properly.

C. Uncover work to provide for installation of ill-timed work.

D. Remove and replace defective work.

E. Remove and replace work not conforming to the Contract Documents.

F. Remove samples of installed work, as specified, for testing.

G. Install specified work in existing construction.

1. In addition to the Contract requirements, upon written instructions from Architect:

   a. Uncover work to provide for Architect's observation of covered work, as required by General Conditions.
   b. Remove samples of installed materials for testing; as required by the General Conditions.

2. Do not endanger any work by cutting or altering work, or any part of it.
3. Do not cut or alter work of another Contractor without written permission of the Architect.
4. Prior to cutting which affects structural safety of Project, or work of another Contractor, submit written notice to Architect requesting consent to proceed with cutting.
5. Prior to cutting and patching, done on instruction of the Architect, submit cost estimate.
6. Should conditions of work, or schedule, indicate change of materials or methods, submit written recommendations to the Architect including:

   a. Conditions indicating change.
   b. Recommendations for alternative materials or methods.
   c. Submittals required for Substitutions.

H. Submit written notice, to the Architect, designating time work will be uncovered, to provide for observation.

I. Payment for costs caused by ill-timed or defective work, or work not conforming to the Contract Documents, including costs for additional services of Architect will be borne by the Contractor.

J. Contractor Inspection:

1. Inspect existing conditions of work, including elements subject to movement or damage during:

   a. Cutting and patching.
   b. Excavating and backfilling.

2. After uncovering work, inspect conditions affecting installation of new products.

K. Preparation: (prior to cutting)

1. Provide shoring, bracing and support as required to maintain structural integrity of the Project.
2. Provide protection for other portions of the Project.
3. Provide protection from the elements.

L. Performance: Perform all work of fitting, adjustment, cutting, patching, finishing, and restoration to perfectly match the quality as specified throughout these specifications.

1.10 CONNECTING TO AND USE OF EXISTING

A. Demolish and remove from site all existing construction work as indicated. Do such work in a neat and orderly manner so as not to endanger the lives of the working force nor cause damage to adjacent surfaces indicated to remain.

B. Remove portions of existing work as indicated or required, and perfectly patch, match and tie into the new work.

C. Repair existing walls, floors, ceilings, partitions, doors, frames, etc., where required for tieing into, including existing systems such as electrical or mechanical, etc.

D. If existing conditions, indicated to remain, include defective work, deteriorated or rotted materials, immediately notify the Architect. Do not conceal such materials.

E. Relocate and remove certain existing items, facilities and equipment, as indicated. Items designated to be removed, and not be re-used, shall remain the property of the Owner and placed on the site where directed by the Owner.

F. Quality of Work/Responsibility to Match Existing:

1. Perfectly match the existing building finishes for all new work, unless otherwise specified or shown. Such matching includes quality, style, character, finish and color. Likewise, repair or replace, in exact likeness to the existing, any existing surfaces, materials, fixtures, or items damaged by the process of completing the new work.

1.11 CONTRACTOR USE OF PREMISES

A. Confine operations at site to areas permitted by:

1. Law.
2. Ordinances.
3. Permits.
4. Contract Documents.

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B. Do not unreasonably encumber the site with materials and equipment.

C. Do not load structure with weight that will endanger structure.

D. Assume full responsibility for protection and safekeeping of products stored on the premises.

E. Move any stored products which interfere with operations of Owner or other Contractor.

F. Obtain and pay for use of additional storage or work areas needed for operations.

G. Limit use of site for work and storage within confines of the Project Limit Line.

1.12 PARTIAL OWNER OCCUPANCY

A. Schedule early completion of designated areas for Owner's usage prior to Substantial Completion of the entire Project.

B. Contractor provide:

1. Access for Owner personnel.
2. Operation of mechanical and electrical systems.

C. Prior to occupancy, execute Certificate of Substantial Completion for designated areas.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 01 00 50

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SECTION 012000 - PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The General Conditions, Supplementary Conditions and applicable portions of Division 1 of the specification are a part of this Section, which shall consist of all labor, equipment and materials necessary to complete all project meeting work indicated on the drawings and herein specified.

1.2 RELATED REQUIREMENTS SPECIFIED ELSEWHERE

A. General Requirements of Construction in Existing Buildings: Section 010050.

1.3 PRECONSTRUCTION MEETING

A. Scheduled, by the Architect, within fifteen days after Notice to Proceed.

B. Attendance:

1. Owner or Representatives.
2. Architect and his Consultants.
3. Contractor.
4. Major Sub-contractors.
5. Safety Representative.

C. Minimum Agenda:

1. Distribution and discussion of:

   a. List of Major Sub-contractors.
   b. Tentative Construction Schedule.

2. Critical work sequencing.
3. Relation and coordination of Contractors.
4. Designation of responsible personnel.
5. Processing of field decisions and Change Orders.
6. Adequacy of distribution of Contract Documents.
7. Submittal of shop drawings, project data and samples.
8. Procedures for maintaining record documents.
9. Use of Premises:

   a. Office and storage areas.
   b. Owner's requirements.

10. Major equipment deliveries and priorities.
11. Housekeeping procedures.
12. Procedures for Project Closeout, including "punch list" preparation and "Substantial Completion" requirements.

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1.4 PROGRESS MEETINGS

A. Scheduled, agendas prepared and administered by the Contractor.

1. Distribute written notice and agendas of Regular and Called Meetings, three days in advance of meeting date.
2. Make physical arrangements for meetings.
3. Preside at meetings.
4. Record minutes, including significant proceedings and decisions.
5. Distribute copies to all attendees, within three days after meeting.

B. Architect will attend meetings to ascertain that Work is expedited consistent with Construction Schedule and with the Contract Documents.

C. Schedule Regular Meetings on a day and time agreeable to all parties.

D. Hold Called Meetings as progress of the Work dictates.

E. Location of meetings, as indicated in the Notice.

F. Attendance:

1. Owner or Representatives, when required.
2. Architect and his Consultants, as required.
3. Contractor.
4. Sub-contractors, as pertinent to agenda.
5. Safety Representative.

G. Minimum Agenda:

1. Review and approve minutes of previous meeting.
2. Review Work progress since last meeting.
3. Note field observations, problems and decisions.
4. Identify problems which impede planned progress.
5. Review off-site fabrication problems.
6. Develop corrective measures and procedures to regain planned schedule.
7. Revise Construction Schedule as required.
8. Plan progress during next work period.
9. Coordinate projected progress with other Contractors.
10. Review submittal schedules, expedite as required to maintain schedule.
11. Maintaining of quality and work standards.
12. Review changes proposed by Owner for:

    a. Effect on Construction Schedule.
    b. Effect on Completion Schedule.

13. Complete other current business.
14. Review Project Closeout procedure.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

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END OF SECTION 012000

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SECTION 012200 - UNIT PRICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

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

B. Related Sections:

1. Division 01 Section "Contract Modification Procedures" for procedures for submitting and handling Change Orders.
2. Division 01 Section "Quality Requirements" for general testing and inspecting requirements.

1.3 DEFINITIONS

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

1.4 PROCEDURES

A. Unit prices include all necessary material, plus cost for delivery, installation, insurance, overhead, and profit. (The Owner is exempt from sales tax; therefore taxes are not to be included.)

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

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

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

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PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 SCHEDULE OF UNIT PRICES (Coordinate with Bid Form)

END OF SECTION 012200

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SECTION 01 25 00 - SUBSTITUTION PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes administrative and procedural requirements for substitutions.

B. Related Requirements:
1. Division 01 Section "Product Requirements" for requirements for submitting comparable product submittals for products by listed manufacturers.
2. Divisions 02 through 33 Sections for specific requirements and limitations for substitutions.

1.3 DEFINITIONS

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

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

1.4 ACTION SUBMITTALS

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

1. Substitution Request Form: Use CSI Form 13.1A and/or facsimile of form.
2. Documentation: Show compliance with requirements for substitutions and the following, as applicable:

a. Statement indicating why specified product or fabrication or installation cannot be provided, if applicable.
b. Coordination information, including a list of changes or revisions needed to other parts of the Work and to construction performed by Owner and separate contractors that will be necessary to accommodate proposed substitution.
c. Detailed comparison of significant qualities of proposed substitution with those of the Work specified. Include annotated copy of applicable Specification Section.

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Significant qualities may include attributes such as performance, weight, size, durability, visual effect, sustainable design characteristics, warranties, and specific features and requirements indicated. Indicate deviations, if any, from the Work specified.

d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
e. Samples, where applicable or requested.
f. Certificates and qualification data, where applicable or requested.
g. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners.
h. Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.
i. Research reports evidencing compliance with building code in effect for Project, from ICC-ES.
j. Detailed comparison of Contractor's construction schedule using proposed substitution with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating date of receipt of purchase order, lack of availability, or delays in delivery.
k. Cost information, including a proposal of change, if any, in the Contract Sum.
l. Contractor's certification that proposed substitution complies with requirements in the Contract Documents except as indicated in substitution request, is compatible with related materials, and is appropriate for applications indicated.
m. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.

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

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

1.5 QUALITY ASSURANCE

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

1.6 PROCEDURES

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

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PART 2 - PRODUCTS

2.1 SUBSTITUTIONS

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

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

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

B. Substitutions for Convenience: Generally not allowed unless otherwise indicated.

C. Substitutions for Convenience: Architect will consider requests for substitution if received within 60 days after the Notice to Proceed and/or the Notice of Award. 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.

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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 01 25 00

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SECTION 01 26 00 - CONTRACT MODIFICATION PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

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

B. Related Requirements:

1. Division 01 Section "Substitution Procedures" for administrative procedures for handling requests for substitutions made after the Contract award.

1.3 PROPOSAL REQUESTS

A. Owner-Initiated Proposal Requests: Architect will issue a detailed description of proposed changes in the Work that may require adjustment to the Contract Sum or the Contract Time. If necessary, the description will include supplemental or revised Drawings and Specifications.

1. Work Change Proposal Requests issued by Architect are not instructions either to stop work in progress or to execute the proposed change.
2. Within 15 days, when not otherwise specified, after receipt of Proposal Request, submit a quotation estimating cost adjustments to the Contract Sum and the Contract Time necessary to execute the change.

a. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
b. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
c. Include costs of labor and supervision directly attributable to the change.
d. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.

B. Contractor-Initiated Proposals: If latent or changed conditions require modifications to the Contract, Contractor may initiate a claim by submitting a request for a change to Architect.

1. Include a statement outlining reasons for the change and the effect of the change on the Work. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the Contract Sum and the Contract Time.

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2. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
3. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
4. Include costs of labor and supervision directly attributable to the change.
5. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
6. Comply with requirements in Division 01 Section "Substitution Procedures" if the proposed change requires substitution of one product or system for product or system specified.
7. Proposal Request Form: Use a form acceptable to Architect.

1.4 ADMINISTRATIVE CHANGE ORDERS

A. Allowance Adjustment: See Division 01 Section "Allowances" for administrative procedures for preparation of Change Order Proposal for adjusting the Contract Sum to reflect actual costs of allowances.

B. Unit-Price Adjustment: See Division 01 Section "Unit Prices" for administrative procedures for preparation of Change Order Proposal for adjusting the Contract Sum to reflect measured scope of unit-price work.

1.5 CHANGE ORDER PROCEDURES

A. On Owner's approval of a Work Changes Proposal Request, General Contractor shall issue a Change Order for signatures of Owner, Contractor and Architect on **AIA Document G701**.

1.6 CONSTRUCTION CHANGE DIRECTIVE

A. Construction Change Directive: Architect may issue a Construction Change Directive on AIA Document G714. Construction Change Directive instructs Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order.

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

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

1. After completion of change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract.

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PART 2 - PRODUCTS (Not used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 26 00

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SECTION 01 29 00 - PAYMENT PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

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

B. Related Requirements:
1. Division 01 Section "Unit Prices" for administrative requirements governing the use of unit prices.
2. Division 01 Section "Contract Modification Procedures" for administrative procedures for handling changes to the Contract.
3. Division 01 Section "Construction Progress Documentation" for administrative requirements governing the preparation and submittal of the Contractor's construction schedule.

1.3 DEFINITIONS

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

1.4 SCHEDULE OF VALUES

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

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

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

2. Submit the schedule of values to Architect at earliest possible date, but no later than ten days before the date scheduled for submittal of initial Applications for Payment.
3. Subschedules for Phased Work: Where the Work is separated into phases requiring separately phased payments, provide subschedules showing values coordinated with each phase of payment.

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4. Subschedules for Separate Elements of Work: Where the Contractor's construction schedule defines separate elements of the Work, provide subschedules showing values coordinated with each element.

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

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

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

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

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

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

4. Provide a breakdown of the Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports. Coordinate with Project Manual table of contents. Provide multiple line items for principal subcontract amounts in excess of five percent of the Contract Sum.

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

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

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

7. Provide separate line items in the schedule of values for initial cost of materials, for each subsequent stage of completion, and for total installed value of that part of the Work.
8. Allowances: Provide a separate line item in the schedule of values for each allowance. Show line-item value of unit-cost allowances, as a product of the unit cost, multiplied by measured quantity. Use information indicated in the Contract Documents to determine quantities.

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9. Purchase Contracts: Provide a separate line item in the schedule of values for each purchase contract. Show line-item value of purchase contract. Indicate owner payments or deposits, if any, and balance to be paid by Contractor.
10. Each item in the schedule of values and Applications for Payment shall be complete. Include total cost and proportionate share of general overhead and profit for each item.

    a. Temporary facilities and other major cost items that are not direct cost of actual work-in-place may be shown either as separate line items in the schedule of values or distributed as general overhead expense, at Contractor's option.

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

1.5 APPLICATIONS FOR PAYMENT

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

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

B. Payment Application Times: The date for each progress payment is indicated in the Agreement between Owner and Contractor. The period of construction work covered by each Application for Payment is the period indicated in the Agreement.

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

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

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

E. Application for Payment Forms: Use forms provided by Owner for Applications for Payment. Sample copies are included in Project Manual.

F. Application for Payment Forms: Use forms acceptable to Architect, Contractor and Owner for Applications for Payment. Submit forms for approval with initial submittal of schedule of values.

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

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

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

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

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

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

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

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

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

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

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

1. List of subcontractors.
2. Schedule of values.
3. Contractor's construction schedule (preliminary if not final).
4. Combined Contractor's construction schedule (preliminary if not final) incorporating Work of multiple contracts, with indication of acceptance of schedule by each Contractor.
5. Products list (preliminary if not final).
6. Schedule of unit prices.
7. Submittal schedule (preliminary if not final).
8. List of Contractor's staff assignments.
9. List of Contractor's principal subcontractors.

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10. Copies of building permits.
11. Copies of authorizations and licenses from authorities having jurisdiction for performance of the Work.
12. Initial progress report.
13. Report of preconstruction conference.
14. Certificates of insurance and insurance policies.
15. Performance and payment bonds.
16. Data needed to acquire Owner's insurance.

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

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

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

1. Evidence of completion of Project closeout requirements.
2. Insurance certificates for products and completed operations where required and proof that taxes, fees, and similar obligations were paid.
3. Updated final statement, accounting for final changes to the Contract Sum.
4. AIA Document G706, "Contractor's Affidavit of Payment of Debts and Claims."
5. AIA Document G706A, "Contractor's Affidavit of Release of Liens."
6. AIA Document G707, "Consent of Surety to Final Payment."
7. Evidence that claims have been settled.
8. Final meter readings for utilities, a measured record of stored fuel, and similar data as of date of Substantial Completion or when Owner took possession of and assumed responsibility for corresponding elements of the Work.
9. Final liquidated damages settlement statement.
10. Build code required contractor certification.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 29 00

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SECTION 014000 - QUALITY REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The General Conditions, Supplementary Conditions and applicable portions of Division 1 of the specification are a part of this Section, which shall consist of all labor, equipment and materials necessary to complete all quality control work indicated on the drawings and herein specified.

1.2 RELATED REQUIREMENTS SPECIFIED ELSEWHERE

1. .
2. Certifications: Individual Specification Sections.
3. Balancing of HVAC Systems: Division 23.

1.3 INSPECTION AND TESTING SERVICES

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

1. Owner will furnish Contractor with names, addresses, and telephone numbers of testing agencies engaged and a description of types of testing and inspecting they are engaged to perform.
2. Payment for these services will be made from testing and inspecting allowances, specified in Section 010200, as authorized by Change Orders.
3. Costs for retesting and reinspecting construction that replaces or is necessitated by work that failed to comply with the Contract Documents will be charged to Contractor.

B. Approvals: Testing agencies, supervising Engineers and laboratories as approved by the Architect.

C. Submittals: Submit two copies of each test result, within seven days of test, to the following:

1. Owner.
2. Contractor.
3. Architect.

1.4 TESTING REQUIRED

A. Earth and Compaction Tests:

1. Refer to applicable Sections of Division 31.
2. Submit certification that all gravel fills within the building and under pavements, only as approved by the Architect, conforms to the analysis specified.
3. Test, at random, each lift and so approve prior to the installation of subsequent lifts.

B. Bituminous Pavements:

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1. Refer to applicable Section of Division 32.
2. Provide plant and field testing and inspection.

C. Concrete:

1. Refer to applicable Sections of Division 3.
2. Provide plant and field testing and inspection.
3. Review, inspect and approve all reinforcing steel installations prior to installation of concrete.

D. Masonry:

1. Refer to applicable Sections of Division 4.
2. Provide field testing and inspection of all masonry work.

1.5 REFERENCES AND QUALITY STANDARDS

A. Conform to reference standard by the date of the issue current on the Date of the Contract Documents.

B. Obtain copies of standards when required by the Contract Documents.

C. Should specified standards conflict with the Contract Documents, request clarification from the Architect prior to proceeding.

D. All materials, workmanship and installation shall be in accordance with the reference material. Failure to be familiar with the reference document shall not excuse the Contractor from the expected quality.

E. In Division 32 reference to "Standard Specifications" is defined to mean "Standard Specifications for Road and Bridge Construction" of the State of Rhode Island and Providence Plantations, Department of Transportation, Division of Public Works, Revision 2004, including all addenda and corrections. References to Methods of Measurements and Basis of Payments do not apply to this Project.

F. Drawings referenced in Division 32 as "Standard Details", refer to the Document entitled "Rhode Island Standard Details - 1998", a document of the Rhode Island Department of Transportation, Division of Public Works, a copy of which is available for review in the Architect's office.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 014000

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SECTION 015000 - TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The General Conditions, Supplementary Conditions and applicable portions of Division 1 of the specification are a part of this Section, which shall consist of all labor, equipment and materials necessary to complete all temporary facilities and controls work indicated on the drawings and herein specified.

1.2 RELATED REQUIREMENTS SPECIFIED ELSEWHERE

A. Safety Requirements: Section 010050.

B. Shoring and Bracing: Section 010050 and Division 31.

1.3 ACCESS

A. Provide an adequate access and/or roads to the site of the structure, if required for the execution of the work.

B. Traffic Controls: Comply with requirements of authorities having jurisdiction.

1. Protect existing site improvements to remain including curbs, pavement, and utilities.
2. Maintain access for fire-fighting equipment and access to fire hydrants.

C. Parking: Use designated areas of Owner's existing parking areas for construction personnel.

D. Provide and maintain at least one permanent or temporary access to each working elevation, which is to be permanently occupied.

E. Provide all necessary scaffolding, platforms, ladders, ramps, chutes, temporary stairs, and maintain in a safe condition throughout the construction process.

1.4 HOISTING FACILITIES

A. Provide hoisting facilities as required for the vertical movement of all materials.

B. Comply with OSHA and other governing codes for all hoists, conveyors, and elevators; and maintain the facilities in compliance with the law.

1.5 GUARDRAILS, FLOOR AND WALL OPENINGS, AND STAIRWAYS

A. Provide guardrails, barricades, handrails and covers for floor, roof and wall openings, and stairways.

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B. Comply with OSHA and other governing codes with regard to standards and requirements for guardrails, openings and stairways.

1.6 TRASH:

A. The goal of the Construction Waste Management program is to divert a minimum of 75% of demolition and construction waste (by weight) from landfill disposal by recycling or salvage.

1.7 SUBMITTALS

A. The contractor will be required to submit a waste management plan to be followed for the duration of construction activities, calling for the separation of specific construction waste materials from the general construction waste stream, to be processed for recycling. The contractor will also be required to provide a breakdown of the materials that were recycled compared to mixed construction waste, broken down by weight, to be submitted to the architect at the end of the project.

1.8 COLLECTION AND DISPOSAL OF WASTES

A. Implement and maintain a construction waste recycling program for the duration of this project. Work with a waste collection company familiar with the process of jobsite recycling to develop and implement a demolition waste recycling program specific to the needs of the project.

B. Maintain separate facilities for the daily collection and sorting of construction debris for recycling to the maximum extent possible. Jobsite recycling area shall be kept accessible and be maintained in a neat and workmanlike manner. Sorted materials shall be removed from site to appropriate recycling facilities on a weekly basis or as required to maintain debris from accumulating.

C. Containers must be clearly labeled and construction personnel must be trained in material sorting policy. Containers must be monitored periodically to ensure that waste is not being mixed with trash or other debris.

1. Sort and handle construction waste for recycling to the extent possible. Remove or arrange for the transport of sorted materials scheduled to be recycled to appropriate off-site facilities equipped for the recycling of specific materials. Provide separate containers and/or compartmentalized dumpsters for the sorting of construction wastes and packaging as follows:

a. Construction wastes to be sorted for recycling include, but are not limited to:

1) Concrete masonry units
2) Aluminum materials
3) Steel materials
4) Copper materials
5) Cardboard packaging
6) Recyclable Plastics
7) Drywall materials.

1.9 DISPOSAL OF DEMOLISHED / RECYCLED MATERIALS

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A. At regular intervals, remove from the site all debris, rubbish and other materials resulting from construction operations, and legally dispose of off the site. Storage or sale of materials for recycling or demolished materials or to be removed will not be permitted on the site.

B. Burning of removed materials from demolished structures, if applicable, will not be permitted on the site.

C. Collect wastes daily.

D. Refer to Section 017100 “Cleaning” for additional requirements.

E. Comply with NFPA 241 for removal of combustible waste.

F. Handle hazardous, dangerous, or unsanitary waste materials separately from other waste by containerizing properly.

G. Dispose of all waste and materials to be recycled in a legal manner.

H. Provide sufficient trash receptacles on each floor of the building.

I. Collect and deposit debris in such collection facilities.

J. Remove all debris from the job site on a regular basis. Do not allow trash to accumulate or remain on site for longer than 48 hours.

1.10 SANITATION FACILITIES

A. Provide adequate temporary toilet facilities.

B. Maintain such facilities in a clean, sanitary condition.

1.11 DRINKING WATER AND SERVICE

A. Provide potable water in convenient and accessible locations.

B. Provide all piping, fitting, valves, connections, etc., necessary for furnishing water during the construction period.

C. Pay costs of water and temporary services.

1.12 TEMPORARY FIRE PROTECTION

A. Provide general, temporary fire protection requirements.

B. Permanent fire protection equipment, used for fire protection during construction, shall be the responsibility of the Installer.

1.13 WEATHER PROTECTION AND TEMPORARY HEAT/VENTILATION

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A. During construction, provide weather protection and heating/ventilating for protection of the work force and construction:

1. Before permanent enclosure of the building;
2. After enclosure, but prior to finishing operations, and;
3. During finishing operations.

B. Refer throughout these specifications for the type, duration and level of requirements for heating/ventilating and weather protection.

C. After permanent enclosures have been installed and the permanent heating system is sufficiently completed to allow safe operation, as determined by the Architect and/or Owner, the permanent system may be used upon written authorization by the Architect. Use of the permanent system in no way implies approval of the installation. Pay all costs for energy consumed.

D. Conserve energy by maintaining maximum temperature and thermostat settings of:

1. 65 degrees F - during normal working hours, and;
2. 58 degrees F - during other periods of time.

E. Coordinate with the work of Division 23.

1.14 TEMPORARY ELECTRICAL SERVICE

A. Provide temporary electric service, power and lighting.

B. Pay all costs for energy consumed during construction.

C. Service cost and installation may be provided under Division 26, as well as any other work of temporary electric service herein specified.

D. Coordinate with Division 26.

E. Provide all required connections, wiring, feeders, lamps, etc., including the following:

F. Provide equivalent of 5 foot candles per 1,000 square feet of floor area in the building. Install sufficient wiring and outlets to insure proper lighting in all temporary construction sheds and all exterior protective lighting. Provide all necessary transformers, motors, cables, panelboards, switches, etc.

G. Provide feeders of sufficient capacity for the requirements of the work, sufficient number of outlets, 120/208 volt, or equivalent, conveniently located so that extension cords not exceeding 100 feet will reach all work requiring artificial light or power.

H. At the end of the day's work, close all light and power, other than the minimum required security illumination.

1.15 STORAGE

A. Coordinate the allocation of storage areas to the various trades and sub-contractors.

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B. Such storage areas shall be approved by the Architect.

C. Maintain such areas in a clean condition at all times.

1.16 SPECIAL CONTROLS

A. Maintain premises and property free from accumulations of waste, debris, and rubbish caused by operations.

B. Hazards Control:

1. Store volatile wastes in covered metal containers, and remove from the premises daily.
2. Prevent accumulation of wastes creating hazardous conditions.
3. Provide adequate ventilation during use of volatile or noxious substances.
4. Conduct cleaning and disposal operations to comply with local ordinances and anti-pollution laws.
5. Do not burn or bury rubbish and waste materials on the project site.
6. Do not dispose of volatile wastes such as mineral spirits, oil or paint thinner in storm or sanitary drains.
7. Do not dispose of wastes into streams or waterways.
8. Remove snow and ice from access to buildings.
9. Maintain cleaning until project, or portion thereof, is occupied by the Owner.

1.17 OTHER TEMPORARY FACILITIES AND CONTROLS

A. Protection of Work-In-Place:

1. Thoroughly protect all completed work and stored materials.
2. Provide boards, cloths, planks, waterproof paper, canvas or other means of protection and use as required to prevent damage.
3. Replace or rectify work or materials damaged by workmen, by the elements or by any other cause, to the satisfaction of the Architect and at no additional expense to the Owner.
4. Do not allow workmen, including those of any sub-contractor or supplier, to mark finish surfaces with marking pens or other such devices which are not readily erasable.

1.18 Special Openings:

A. Early in the work, confer with all parties providing apparatus of various kinds. Should any be of a size and character that cannot be properly taken into the building to its indicated position through openings shown, make necessary arrangements for the installation of such items in a manner satisfactory to those providing them and to the Owner. Make good on any damage that may be caused thereby.

1.19 REMOVAL OF TEMPORARY FACILITIES

A. Remove all items indicated above and other construction of a temporary nature from the site as soon as the progress of the work, in the opinion of the Architect, will permit.

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B. Recondition the portions of the site so occupied and restore to a condition acceptable to the Architect.

PART 2 - PRODUCTS

2.1 TEMPORARY FENCING

A. Chain-Link Fencing: Minimum 2-inch (50-mm), 0.148-inch- (3.8-mm-) thick, galvanized steel, chain-link fabric fencing; minimum 6 feet (1.8 m) high with galvanized steel pipe posts; minimum 2-3/8-inch- (60-mm-) OD line posts and 2-7/8-inch- (73-mm-) OD corner and pull posts, with 1-5/8-inch- (42-mm-) OD top rails.

B. Portable Chain-Link Fencing: Minimum 2-inch (50-mm), 0.148-inch- (3.8-mm-) thick, galvanized steel, chain-link fabric fencing; minimum 6 feet (1.8 m) high with galvanized steel pipe posts; minimum 2-3/8-inch- (60-mm-) OD line posts and 2-7/8-inch- (73-mm-) OD corner and pull posts, with 1-5/8-inch- (42-mm-) OD top and bottom rails. Provide concrete bases for supporting posts.

PART 3 - EXECUTION

A. SITE ENCLOSURE

1. Site Enclosure Fence: Before construction operations begin, furnish and install site enclosure fence in a manner that will prevent people and animals from easily entering site except by entrance gates.
2. Extent of Fence: As required to enclose entire Project site or portion determined sufficient to accommodate construction operations.
3. Maintain security by limiting number of keys and restricting distribution to authorized personnel. Furnish one set of keys to Owner's Representative.

END OF SECTION 015000

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SECTION 016000 - PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

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

B. See Division 01 Section "Closeout Procedures" for submitting warranties for Contract closeout.

C. See Divisions 02 through 33 Sections for specific requirements for warranties on products and installations specified to be warranted.

1.2 DEFINITIONS

A. Products: Items purchased for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.

1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation shown or listed in manufacturer's published product literature, that is current as of date of the Contract Documents.
2. New Products: Items that have not previously been incorporated into another project or facility, except that products consisting of recycled-content materials are allowed, unless explicitly stated otherwise. Products salvaged or recycled from other projects are not considered new products.
3. Comparable Product: Product that is demonstrated and approved through submittal process, or where indicated as a product substitution, to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.

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

C. Basis-of-Design Product Specification: Where a specific manufacturer's product is named and accompanied by the words "basis of design," including make or model number or other designation, to establish the significant qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics for purposes of evaluating comparable products of other named manufacturers.

1.3 SUBMITTALS

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

1. Substitution Request Form: Use form approved by Architect.

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2. 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.

3. Architect's Action: 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.

   a. Form of Acceptance: Change Order.
   b. Use product specified if Architect cannot make a decision on use of a proposed substitution within time allocated.

B. Comparable Product 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. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within one week of receipt of a comparable product request. Architect will notify Contractor of approval or rejection of proposed comparable product request within 15 days of receipt of request, or 7 days of receipt of additional information or documentation, whichever is later.

   a. Form of Approval: As specified in Division 01 Section "Submittal Procedures."

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b. Use product specified if Architect cannot make a decision on use of a comparable product request within time allocated.

C. Basis-of-Design Product Specification Submittal: Comply with requirements in Division 01 Section "Submittal Procedures." Show compliance with requirements.

1.4 QUALITY ASSURANCE

A. Compatibility of Options: If Contractor is given option of selecting between two or more products for use on Project, product selected shall be compatible with products previously selected, even if previously selected products were also options.

1.5 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft. 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 ensure compliance with the Contract Documents and to ensure that products are undamaged and properly protected.

C. Storage:

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

1.6 PRODUCT WARRANTIES

A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.

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1. Manufacturer's Warranty: Preprinted written warranty published by individual manufacturer for a particular product and specifically endorsed by manufacturer to Owner.
2. Special Warranty: Written warranty required by or incorporated into the Contract Documents, either to extend time limit provided by manufacturer's warranty or to provide more rights for Owner.

B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution. Submit a draft for approval before final execution.

1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.
2. Specified Form: When specified forms are included with the Specifications, prepare a written document using appropriate form properly executed.
3. Refer to Divisions 2 through 16 Sections for specific content requirements and particular requirements for submitting special warranties.

C. Submittal Time: Comply with requirements in Division 01 Section "Closeout Procedures."

PART 2 - PRODUCTS

2.1 PRODUCT SELECTION PROCEDURES

A. General Product Requirements: Provide products that comply with the Contract Documents, that are undamaged and, unless otherwise indicated, that are new at time of installation.

1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
3. Owner reserves the right to limit selection to products with warranties not in conflict with requirements of the Contract Documents.
4. Where products are accompanied by the term "as selected," Architect will make selection.
5. Where products are accompanied by the term "match sample," sample to be matched is Architect's.
6. Descriptive, performance, and reference standard requirements in the Specifications establish "salient characteristics" of products.

B. Product Selection Procedures:

1. Product: Where Specifications name a single product and manufacturer, provide the named product that complies with requirements.
2. Manufacturer/Source: Where Specifications name a single manufacturer or source, provide a product by the named manufacturer or source that complies with requirements.
3. Products: Where Specifications include a list of names of both products and manufacturers, provide one of the products listed that complies with requirements.
4. Manufacturers: Where Specifications include a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements.
5. Available Products: Where Specifications include a list of names of both products and manufacturers, provide one of the products listed, or an unnamed product, that complies

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with requirements. Comply with provisions in Part 2 "Comparable Products" Article for consideration of an unnamed product.

6. Available Manufacturers: Where Specifications include a list of manufacturers, provide a product by one of the manufacturers listed, or an unnamed manufacturer, that complies with requirements. Comply with provisions in Part 2 "Comparable Products" Article for consideration of an unnamed product.
7. Product Options: Where Specifications indicate that sizes, profiles, and dimensional requirements on Drawings are based on a specific product or system, provide the specified product or system. Comply with provisions in Part 2 "Product Substitutions" Article for consideration of an unnamed product or system.
8. Basis-of-Design Product: Where Specifications name a product and include a list of manufacturers, provide the specified product or a comparable product by one of the other named manufacturers. Drawings and Specifications indicate sizes, profiles, dimensions, and other characteristics that are based on the product named. Comply with provisions in Part 2 "Comparable Products" Article for consideration of an unnamed product by the other named manufacturers.
9. Visual Matching Specification: Where Specifications require matching an established Sample, select a product that complies with requirements and matches Architect's sample. Architect's decision will be final on whether a proposed product matches.

    a. If no product available within specified category matches and complies with other specified requirements, comply with provisions in Part 2 "Product Substitutions" Article for proposal of product.

10. Visual Selection Specification: Where Specifications include the phrase "as selected from manufacturer's colors, patterns, textures" or a similar phrase, select a product that complies with other specified requirements.

    a. Standard Range: Where Specifications include the phrase "standard range of colors, patterns, textures" or similar phrase, Architect will select color, pattern, density, or texture from manufacturer's product line that does not include premium items.
    b. Full Range: Where Specifications include the phrase "full range of colors, patterns, textures" or similar phrase, Architect will select color, pattern, density, or texture from manufacturer's product line that includes both standard and premium items.

2.2 PRODUCT SUBSTITUTIONS

A. 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.

B. 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:

1. 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.
2. Requested substitution does not require extensive revisions to the Contract Documents.

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3. Requested substitution is consistent with the Contract Documents and will produce indicated results.
4. Substitution request is fully documented and properly submitted.
5. Requested substitution will not adversely affect Contractor's Construction Schedule.
6. Requested substitution has received necessary approvals of authorities having jurisdiction.
7. Requested substitution is compatible with other portions of the Work.
8. Requested substitution has been coordinated with other portions of the Work.
9. Requested substitution provides specified warranty.

2.3 COMPARABLE PRODUCTS

A. Conditions: Architect will consider Contractor's request for comparable product 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:

1. Evidence that the proposed product does not require extensive revisions to the Contract Documents, that it is consistent with the Contract Documents and will produce the indicated results, and that it is compatible with other portions of the Work.
2. Detailed comparison of significant qualities of proposed product with those named in the Specifications. Significant qualities include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
3. Evidence that proposed product provides specified warranty.
4. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners, if requested.
5. Samples, if requested.

PART 3 - EXECUTION (Not Used)

END OF SECTION 016000

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SECTION 017100 - CLEANING

PART 1 - GENERAL

1.1 REQUIREMENTS INCLUDED

A. Execute cleaning, during progress of the work, and at completion of the work, as required by General Conditions.

1.2 RELATED REQUIREMENTS

A. Conditions of the contract.

B. Each Specification Section: Cleaning for specific products or work.

1.3 DISPOSAL REQUIREMENTS

A. Conduct cleaning and disposal operations to comply with all local codes, ordinances, regulations and anti-pollution laws.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Use only those cleaning materials which will not create hazards to health or property and which will not damage surfaces.

B. Use only those cleaning materials and methods recommended by manufacturer of the surface material to be cleaned.

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

PART 3 - EXECUTION

3.1 DURING CONSTRUCTION

A. Execute periodic cleaning, not less than weekly, to keep the work, the site and adjacent properties free from accumulations of waste materials, rubbish and windblown debris resulting from construction operations.

B. Provide on-site containers for the collection of waste materials, debris and rubbish per Section 015000.

C. Remove waste materials, debris and rubbish from the site periodically, and dispose of at legal disposal areas away from the site.

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3.2 DUST CONTROL

A. Clean interior spaces prior to the start of finish painting, and continue cleaning on an as-needed basis until painting is finished.

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

3.3 PROGRESSIVE CLEANING

A. Cleaning during construction is the responsibility of the Contractor. All areas shall be cleaned in a manner acceptable to Owner's Representative. Two (2) full-time cleaning personnel with tools shall be provided from completion of the flooring, until occupation by Owner's operations, whose primary function shall be cleaning the Facility in a manner acceptable to Owner's representative.

3.4 FINAL CLEANING

A. Final cleaning before final inspection. Interior and exterior areas of the building shall be cleared of all rubbish and thoroughly cleaned by the Contractor, including the following:

1. All construction facilities, debris, and rubbish shall be removed from the Owner's property and legally disposed of.
2. All finished surfaces including floors, walls and ceilings shall be swept, dusted, washed, waxed and polished. This includes cleaning of the work of all finished trades where needed, whether or not cleaning for such trades is included in their respective SECTIONS.
3. Pipe and duct spaces, chases, and furred spaces shall be left thoroughly cleaned.
4. All glass and mirrors shall be washed and polished, both sides, by a Window Cleaning Contractor specializing in such work.
5. All ceilings, wall surfaces, floors, door frames, hardware, metal work, glass, enameled metals, and the like, shall be cleaned.

3.5 VENTILATING SYSTEMS:

A. Replace temporary filters with permanent filters. See Division 23 for requirements regarding disposable filters. Do not operate the fan system unless temporary filters conforming to the requirements of Division 23 are in place.

B. Clean ducts, blowers and coils if units were operated without filters during construction.

C. Replace all HVAC filtration media with new filtration media as indicated above and conduct a flushing out the building at 100% outside air for two weeks after construction ends, and prior to occupancy of the building.

3.6 OTHER CLEANING

A. Broom clean exterior paved surfaces, rake clean other surfaces of the grounds disturbed by construction.

B. 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 017100

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SECTION 017300 - EXECUTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes general administrative and procedural requirements governing execution of the Work including, but not limited to, the following:

1. Construction layout.
2. Installation of the Work.
3. Cutting and patching.
4. Coordination of Owner-installed products.
5. Progress cleaning.
6. Starting and adjusting.
7. Protection of installed construction.
8. Correction of the Work.

B. Related Requirements:

1. Division 01 Section "General Requirements" for limits on use of Project site.
2. Division 01 Section "Submittal Procedures" for submitting surveys.
3. Division 01 Section "Closeout Procedures" for submitting final property survey with Project Record Documents, recording of Owner-accepted deviations from indicated lines and levels, and final cleaning.
4. Division 02 Section "Selective Structure Demolition" for demolition and removal of selected portions of the building.

1.3 DEFINITIONS

A. Cutting: Removal of in-place construction necessary to permit installation or performance of other work.

B. Patching: Fitting and repair work required to restore construction to original conditions after installation of other work.

1.4 INFORMATIONAL SUBMITTALS

A. Cutting and Patching Plan: Submit plan describing procedures at least 10 days prior to the time cutting and patching will be performed. Include the following information:

1. Extent: Describe reason for and extent of each occurrence of cutting and patching.

2. Changes to In-Place Construction: Describe anticipated results. Include changes to structural elements and operating components as well as changes in building appearance and other significant visual elements.
3. Products: List products to be used for patching and firms or entities that will perform patching work.
4. Dates: Indicate when cutting and patching will be performed.
5. Utilities and Mechanical and Electrical Systems: List services and systems that cutting and patching procedures will disturb or affect. List services and systems that will be relocated and those that will be temporarily out of service. Indicate length of time permanent services and systems will be disrupted.

    a. Include description of provisions for temporary services and systems during interruption of permanent services and systems.

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

1.5 QUALITY ASSURANCE

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

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

2. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety. Operational elements include, but are not limited to, the following:

    a. Primary operational systems and equipment.
    b. Fire separation assemblies.
    c. Air or smoke barriers.
    d. Fire-suppression systems.
    e. Mechanical systems piping and ducts.
    f. Control systems.
    g. Communication systems.
    h. Fire-detection and -alarm systems.
    i. Conveying systems.
    j. Electrical wiring systems.
    k. Operating systems of special construction.

3. Other Construction Elements: Do not cut and patch other construction elements or components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or that results in increased maintenance or decreased operational life or safety. Other construction elements include but are not limited to the following:

    a. Water, moisture, or vapor barriers.
    b. Membranes and flashings.

c. Exterior curtain-wall construction.
d. Sprayed fire-resistive material.
e. Equipment supports.
f. Piping, ductwork, vessels, and equipment.
g. Noise- and vibration-control elements and systems.

4. Visual Elements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch exposed construction in a manner that would, in Architect's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.

B. Cutting and Patching Conference: Before proceeding, meet at Project site with parties involved in cutting and patching, including mechanical and electrical trades. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.

C. Manufacturer's Installation Instructions: Obtain and maintain on-site manufacturer's written recommendations and instructions for installation of products and equipment.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General: Comply with requirements specified in other Sections.

1. For projects requiring compliance with sustainable design and construction practices and procedures, use products for patching that comply with requirements in Division 01 sustainable design requirements Section.

B. In-Place Materials: Use materials for patching identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.

1. If identical materials are unavailable or cannot be used, use materials that, when installed, will provide a match acceptable to Architect for the visual and functional performance of in-place materials.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Existing Conditions: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning sitework, investigate and verify the existence and location of underground utilities, mechanical and electrical systems, and other construction affecting the Work.

1. Before construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, and water-service piping; underground electrical services, and other utilities.
2. Furnish location data for work related to Project that must be performed by public utilities serving Project site.

B. Examination and Acceptance of Conditions: Before proceeding with each component of the Work, examine substrates, areas, and conditions, with Installer or Applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.

1. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
2. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
3. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.

C. Written Report: Where a written report listing conditions detrimental to performance of the Work is required by other Sections, include the following:

1. Description of the Work.
2. List of detrimental conditions, including substrates.
3. List of unacceptable installation tolerances.
4. Recommended corrections.

D. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Existing Utility Information: Furnish information to local utility and Owner that is necessary to adjust, move, or relocate existing utility structures, utility poles, lines, services, or other utility appurtenances located in or affected by construction. Coordinate with authorities having jurisdiction.

B. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

C. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.

D. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents caused by differing field conditions outside the control of Contractor, submit a request for information to Architect according to requirements in Division 01 Section "Project Management and Coordination."

3.3 CONSTRUCTION LAYOUT

A. Verification: Before proceeding to lay out the Work, verify layout information shown on Drawings. If discrepancies are discovered, notify Architect promptly.

3.4 INSTALLATION

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

1. Make vertical work plumb and make horizontal work level.
2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
3. Conceal pipes, ducts, and wiring in finished areas unless otherwise indicated.
4. Maintain minimum headroom clearance of 90 inches (2300 mm) in all spaces.

B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.

C. Install products at the time and under conditions that will ensure the best possible results. Maintain conditions required for product performance until Substantial Completion.

D. Conduct construction operations so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy.

E. Sequence the Work and allow adequate clearances to accommodate movement of construction items on site and placement in permanent locations.

F. Tools and Equipment: Do not use tools or equipment that produce harmful noise levels.

G. Templates: Obtain and distribute to the parties involved templates for work specified to be factory prepared and field installed. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing products to comply with indicated requirements.

H. Attachment: Provide blocking and attachment plates and anchors and fasteners of adequate size and number to securely anchor each component in place, accurately located and aligned with other portions of the Work. Where size and type of attachments are not indicated, verify size and type required for load conditions.

1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Architect.
2. Allow for building movement, including thermal expansion and contraction.
3. Coordinate installation of anchorages. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

I. Joints: Make joints of uniform width. Where joint locations in exposed work are not indicated, arrange joints for the best visual effect. Fit exposed connections together to form hairline joints.

J. Hazardous Materials: Use products, cleaners, and installation materials that are not considered hazardous.

3.5 CUTTING AND PATCHING

A. Cutting and Patching, General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.

1. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.

B. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during installation or cutting and patching operations, by methods and with materials so as not to void existing warranties.

C. Temporary Support: Provide temporary support of work to be cut.

D. Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.

E. Adjacent Occupied Areas: Where interference with use of adjoining areas or interruption of free passage to adjoining areas is unavoidable, coordinate cutting and patching according to requirements in Division 01 Section "Summary."

F. Existing Utility Services and Mechanical/Electrical Systems: Where existing services/systems are required to be removed, relocated, or abandoned, bypass such services/systems before cutting to prevent interruption to occupied areas.

G. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.

1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots neatly to minimum size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
2. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
3. Concrete and Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
4. Excavating and Backfilling: Comply with requirements in applicable Division 31 Sections where required by cutting and patching operations.
5. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.
6. Proceed with patching after construction operations requiring cutting are complete.

H. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other work. Patch with durable seams that are as invisible as practicable. Provide materials and comply with installation requirements specified in other Sections, where applicable.

1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate physical integrity of installation.
2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will minimize evidence of patching and refinishing.

    a. Clean piping, conduit, and similar features before applying paint or other finishing materials.
    b. Restore damaged pipe covering to its original condition.

3. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove in-place floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.

    a. Where patching occurs in a painted surface, prepare substrate and apply primer and intermediate paint coats appropriate for substrate over the patch, and apply final paint coat over entire unbroken surface containing the patch. Provide additional coats until patch blends with adjacent surfaces.

4. Ceilings: Patch, repair, or rehang in-place ceilings as necessary to provide an even-plane surface of uniform appearance.
5. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition and ensures thermal and moisture integrity of building enclosure.

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

3.6 OWNER-INSTALLED PRODUCTS

A. Site Access: Provide access to Project site for Owner's construction personnel.

B. Coordination: Coordinate construction and operations of the Work with work performed by Owner's construction personnel.

1. Construction Schedule: Inform Owner of Contractor's preferred construction schedule for Owner's portion of the Work. Adjust construction schedule based on a mutually agreeable timetable. Notify Owner if changes to schedule are required due to differences in actual construction progress.
2. Preinstallation Conferences: Include Owner's construction personnel at preinstallation conferences covering portions of the Work that are to receive Owner's work. Attend preinstallation conferences conducted by Owner's construction personnel if portions of the Work depend on Owner's construction.

3.7 PROGRESS CLEANING

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

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1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
2. Do not hold waste materials more than seven days during normal weather or three days if the temperature is expected to rise above 80 deg F (27 deg C).
3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.

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

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

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

C. Work Areas: Clean areas where work is in progress to the level of cleanliness necessary for proper execution of the Work.

1. Remove liquid spills promptly.
2. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.

D. Installed Work: Keep installed work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.

E. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.

F. Exposed Surfaces in Finished Areas: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.

G. Waste Disposal: Do not bury or burn waste materials on-site. Do not wash waste materials down sewers or into waterways. Comply with waste disposal requirements in Division 01 Section Construction Waste Management and Disposal.

H. During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.

I. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.

J. Limiting Exposures: Supervise construction operations to assure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

3.8 STARTING AND ADJUSTING

A. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.

B. Adjust equipment for proper operation. Adjust operating components for proper operation without binding.

C. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

D. Manufacturer's Field Service: Comply with qualification requirements in Division 01 Section "Quality Requirements."

3.9 PROTECTION OF INSTALLED CONSTRUCTION

A. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion.

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

END OF SECTION 017300

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SECTION 01 74 20 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

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

1. Salvaging nonhazardous waste.
2. Recycling nonhazardous waste.
3. Disposing of nonhazardous waste.

B. Related Requirements:
1. Division 02 Section "Selective Structure Demolition" for disposition of waste resulting from partial demolition of buildings, structures, and site improvements, and for disposition of hazardous waste.

1.3 DEFINITIONS

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

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

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

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

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.

1.4 PERFORMANCE REQUIREMENTS

A. General: Achieve end-of-Project rates for salvage/recycling of **50** percent by weight of total non-hazardous solid waste generated by the Work. Practice efficient waste management in the use of materials in the course of the Work. Use all reasonable means to divert construction and

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demolition waste from landfills and incinerators. Facilitate recycling and salvage of materials, including the following:

1. Demolition Waste (which may include the following when within the project scope):

    a. Asphalt paving.
    b. Concrete.
    c. Concrete reinforcing steel.
    d. Brick.
    e. Concrete masonry units.
    f. Wood studs.
    g. Wood joists.
    h. Plywood and oriented strand board.
    i. Wood paneling.
    j. Wood trim.
    k. Structural and miscellaneous steel.
    l. Rough hardware.
    m. Roofing.
    n. Insulation.
    o. Doors and frames.
    p. Door hardware.
    q. Windows.
    r. Glazing.
    s. Metal studs.
    t. Gypsum board.
    u. Acoustical tile and panels.
    v. Carpet.
    w. Carpet pad.
    x. Demountable partitions.
    y. Equipment.
    z. Cabinets.
    aa. Plumbing fixtures.
    bb. Piping.
    cc. Supports and hangers.
    dd. Valves.
    ee. Sprinklers.
    ff. Mechanical equipment.
    gg. Refrigerants.
    hh. Electrical conduit.
    ii. Copper wiring.
    jj. Lighting fixtures.
    kk. Lamps.
    ll. Ballasts.
    mm. Electrical devices.
    nn. Switchgear and panelboards.
    oo. Transformers.

2. Construction Waste (which may include the following when within the project scope):

    a. Masonry and CMU.
    b. Lumber.
    c. Wood sheet materials.
    d. Wood trim.
    e. Metals.
    f. Roofing.

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g. Insulation.
h. Carpet and pad.
i. Gypsum board.
j. Piping.
k. Electrical conduit.
l. Packaging: Regardless of salvage/recycle goal indicated in "General" Paragraph above, salvage or recycle 100 percent of the following uncontaminated packaging materials:

1) Paper.
2) Cardboard.
3) Boxes.
4) Plastic sheet and film.
5) Polystyrene packaging.
6) Wood crates.
7) Plastic pails.

1.5 QUALITY ASSURANCE

A. Waste Management Coordinator Qualifications: Experienced firm, with a record of successful waste management coordination of projects with similar requirements, as waste management coordinator.

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

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

D. Waste Management Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "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.

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PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 PLAN IMPLEMENTATION

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

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

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

C. Training: Train workers, subcontractors, and suppliers on proper waste management procedures, as appropriate for the Work.

1. Distribute waste management plan to everyone concerned within three days of submittal return.
2. Distribute waste management plan to entities when they first begin work on-site. Review plan procedures and locations established for salvage, recycling, and disposal.

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

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

3.2 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.

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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 on-site 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.

3.3 RECYCLING DEMOLITION AND CONSTRUCTION WASTE, GENERAL

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

B. Recycling Receivers and Processors: Use only available recycling receivers and processors licensed to do business in the local area.

C. Recycling Incentives: Revenues, savings, rebates, tax credits, and other incentives received for recycling waste materials shall be shared equally by Owner and Contractor.

D. 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.

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

1. Provide appropriately marked containers or bins for controlling recyclable waste until removed from Project site. Include list of acceptable and unacceptable materials at each container and bin.

   a. Inspect containers and bins for contamination and remove contaminated materials if found.

2. Stockpile processed materials on-site without intermixing with other materials. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
3. Stockpile materials away from construction area. Do not store within drip line of remaining trees.
4. Store components off the ground and protect from the weather.
5. Remove recyclable waste from Owner's property and transport to recycling receiver or processor.

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3.4 RECYCLING DEMOLITION WASTE

A. Asphalt Paving: Grind asphalt to maximum 1-1/2-inch (38-mm) or 4-inch (100-mm) size.

1. Crush asphaltic concrete paving and screen to comply with requirements in Division 31 Section "Earth Moving" for use as general fill.

B. Asphalt Paving: Break up and transport paving to asphalt-recycling facility.

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

1. Pulverize concrete to maximum 1-1/2-inch (38-mm) size.
2. Crush concrete and screen to comply with requirements in Division 31 Section "Earth Moving" for use as satisfactory soil for fill or subbase.

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

1. Pulverize masonry to maximum 1-inch (25-mm) size.

a. Crush masonry and screen to comply with requirements in Division 31 Section "Earth Moving" for use as general fill or satisfactory soil for fill or subbase.
b. Crush masonry and screen to comply with requirements in Division 32 Section "Plants" for use as mineral mulch.

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

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

F. 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.

G. Asphalt Shingle Roofing: Separate organic and glass-fiber asphalt shingles and felts. Remove and dispose of nails, staples, and accessories.

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

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

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

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

1. Store clean, dry carpet and pad in a closed container or trailer provided by Carpet Reclamation Agency or carpet recycler.

L. Carpet Tile: Remove debris, trash, and adhesive.

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1. Stack tile on pallet and store clean, dry carpet in a closed container or trailer provided by Carpet Reclamation Agency or carpet recycler.

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

3.5 RECYCLING CONSTRUCTION WASTE

A. Packaging:

1. Cardboard and Boxes: Break down packaging into flat sheets. Bundle and store in a dry location.
2. Polystyrene Packaging: Separate and bag materials.
3. Pallets: As much as possible, require deliveries using pallets to remove pallets from Project site. For pallets that remain on-site, break down pallets into component wood pieces and comply with requirements for recycling wood.
4. Crates: Break down crates into component wood pieces and comply with requirements for recycling wood.

B. Wood Materials:

1. Clean Cut-Offs of Lumber: Grind or chip into small pieces.
2. Clean Sawdust: Bag sawdust that does not contain painted or treated wood.

a. Comply with requirements in Division 32 Section "Plants." for use of clean sawdust as organic mulch.

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

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

a. Comply with requirements in Division 32 Section "Plants." for use of clean ground gypsum board as inorganic soil amendment.

3.6 DISPOSAL OF WASTE

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

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

B. Burning: Do not burn waste materials.

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C. Burning: Burning of waste materials is permitted only at designated areas on Owner's property, provided required permits are obtained. Provide full-time monitoring for burning materials until fires are extinguished.

D. Disposal: Remove waste materials and dispose of at designated spoil areas on Owner's property.

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

END OF SECTION 01 74 19

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SECTION 017700 - CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

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

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

1.3 SUBSTANTIAL COMPLETION

A. Preliminary Procedures: Before requesting inspection for determining date of Substantial Completion, complete the following. List items below that are incomplete in request.

1. Prepare a list of items to be completed and corrected (punch list), the value of items on the list, and reasons why the Work is not complete.
2. Advise Owner of pending insurance changeover requirements.
3. Submit specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
4. Obtain and submit releases permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
5. Prepare and submit Project Record Documents, operation and maintenance manuals, Final Completion construction photographs, damage or settlement surveys, property surveys, and similar final record information.
6. Deliver tools, spare parts, extra materials, and similar items to location designated by Owner. Label with manufacturer's name and model number where applicable.
7. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
8. Complete startup testing of systems.
9. Submit test/adjust/balance records.
10. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
11. Advise Owner of changeover in heat and other utilities.
12. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.
13. Complete final cleaning requirements, including touchup painting.
14. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.

B. Inspection: Submit a written request for inspection for Substantial Completion. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare the Certificate of Substantial Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by Architect, that must be completed or corrected before certificate will be issued.

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

1.4 FINAL COMPLETION

A. Preliminary Procedures: Before requesting final inspection for determining date of Final Completion, complete the following:

1. Submit a final Application for Payment according to Division 01 Section "Payment Procedures."
2. Submit certified copy of Architect's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Architect. The certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
3. Submit evidence of final, continuing insurance coverage complying with insurance requirements.
4. Submit pest-control final inspection report and warranty.
5. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems.
6. Fill all fuel tanks, propane, etc.

B. Inspection: Submit a written request for final inspection for acceptance. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare a final Certificate for Payment after inspection or will notify Contractor of construction that must be completed or corrected before certificate will be issued.

1. Re-inspection: Request re-inspection when the Work identified in previous inspections as incomplete is completed or corrected.

1.5 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

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

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

   a. Project name.
   b. Date.
   c. Name of Architect.

d. Name of Contractor.
e. Page number.

1.6 WARRANTIES

A. Submittal Time: Submit written warranties on request of Architect for designated portions of the Work where commencement of warranties other than date of Substantial Completion is indicated.

B. Partial Occupancy: Submit properly executed warranties within 15 days of completion of designated portions of the Work that are completed and occupied or used by Owner during construction period by separate agreement with Contractor.

C. Organize warranty documents into an orderly sequence based on the table of contents of the Project Manual.

1. Bind warranties and bonds in heavy-duty, 3-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch paper.
2. Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product and the name, address, and telephone number of Installer.
3. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project name, and name of Contractor.

D. Provide additional copies of each warranty to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.

PART 3 - EXECUTION

3.1 FINAL CLEANING

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

B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.

1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a portion of Project:

   a. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
   b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
   c. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.
   d. Remove tools, construction equipment, machinery, and surplus material from Project site.
   e. Remove snow and ice to provide safe access to building.
   f. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
   g. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
   h. Sweep concrete floors broom clean in all spaces.
   i. 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.
   j. Remove labels that are not permanent.
   k. Touch up and otherwise repair and restore marred, exposed finishes and surfaces. Replace finishes and surfaces that cannot be satisfactorily repaired or restored or that already show evidence of repair or restoration.

      1) Do not paint over "UL" and similar labels, including mechanical and electrical nameplates.

   l. Wipe surfaces of mechanical and electrical equipment, elevator equipment, and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
   m. Replace parts subject to unusual operating conditions.
   n. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
   o. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
   p. Clean ducts, blowers, and coils if units were operated without filters during construction.
   q. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency. Replace burned-out bulbs, and those noticeably dimmed by hours of use, and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.
   r. Leave Project clean and ready for occupancy.

C. Pest Control: Engage an experienced, licensed exterminator to make a final inspection and rid Project of rodents, insects, and other pests. Prepare a report.

D. Comply with safety standards for cleaning. Do not burn waste materials. Do not bury debris or excess materials on Owner's property. Do not discharge volatile, harmful, or dangerous

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materials into drainage systems. Remove waste materials from Project site and dispose of lawfully.

END OF SECTION 017700

SECTION 017839 - PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

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

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

B. Related Sections include the following:

1. Division 01 Section "Closeout Procedures" for general closeout procedures.

1.3 SUBMITTALS

A. Record Drawings: Comply with the following:

1. Number of Copies: Submit two sets of marked-up Record Prints.
2. Number of Copies: Submit copies of Record Drawings as follows:

a. Initial Submittal: Submit one set of plots from corrected Record CAD Drawings and one set of marked-up Record Prints. Architect will initial and date each plot and mark whether general scope of changes, additional information recorded, and quality of drafting are acceptable. Architect will return plots and prints for organizing into sets, printing, binding, and final submittal.
b. Final Submittal: Submit two sets of marked-up Record Prints, one set of Record CAD Drawing files, one set of Record CAD Drawing plots, and three copies printed from record plots. Plot and print each Drawing, whether or not changes and additional information were recorded.

1) Electronic Media: CD-R.

B. Record Specifications: Submit one copy of Project's Specifications, including addenda and contract modifications.

C. Record Product Data: Submit one copy of each Product Data submittal.

1. Where Record Product Data is required as part of operation and maintenance manuals, submit marked-up Product Data as an insert in manual instead of submittal as Record Product Data.

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PART 2 - PRODUCTS

2.1 RECORD DRAWINGS

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

1. Preparation: Mark Record Prints to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to prepare the marked-up Record Prints.

   a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
   b. Accurately record information in an understandable drawing technique.
   c. Record data as soon as possible after obtaining it. Record and check the markup before enclosing concealed installations.

2. Content: Types of items requiring marking include, but are not limited to, the following:

   a. Dimensional changes to Drawings.
   b. Revisions to details shown on Drawings.
   c. Depths of foundations below first floor.
   d. Locations and depths of underground utilities.
   e. Revisions to routing of piping and conduits.
   f. Revisions to electrical circuitry.
   g. Actual equipment locations.
   h. Duct size and routing.
   i. Locations of concealed internal utilities.
   j. Changes made by Change Order or Construction Change Directive.
   k. Changes made following Architect's written orders.
   l. Details not on the original Contract Drawings.
   m. Field records for variable and concealed conditions.
   n. Record information on the Work that is shown only schematically.

3. Mark the Contract Drawings or Shop Drawings, whichever is most capable of showing actual physical conditions, completely and accurately. If Shop Drawings are marked, show cross-reference on the Contract Drawings.
4. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.
5. Mark important additional information that was either shown schematically or omitted from original Drawings.
6. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.
7. Incorporate changes and additional information previously marked on Record Prints. Erase, redraw, and add details and notations where applicable.
8. Refer instances of uncertainty to Architect for resolution.
9. Owner will furnish Contractor one set of transparencies of the Contract Drawings for use in recording information.
10. Print the Contract Drawings and Shop Drawings for use as Record Transparencies. Architect will make the Contract Drawings available to Contractor's print shop.

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B. Record CAD Drawings: Immediately before inspection for Certificate of Substantial Completion, review marked-up Record Prints with Architect. When authorized, prepare a full set of corrected CAD Drawings of the Contract Drawings, as follows:

1. Format: Same CAD program, version, and operating system as the original Contract Drawings.
2. Format: DWG, Version 2004, operating in Microsoft Windows operating system.
3. Incorporate changes and additional information previously marked on Record Prints. Delete, redraw, and add details and notations where applicable.
4. Refer instances of uncertainty to Architect for resolution.
5. Architect will furnish Contractor one set of CAD Drawings of the Contract Drawings for use in recording information.

    a. Architect makes no representations as to the accuracy or completeness of CAD Drawings as they relate to the Contract Drawings.
    b. CAD Software Program: The Contract Drawings are available in AutoCad 2004 - 2015.

C. Newly Prepared Record Drawings: Prepare new Drawings instead of preparing Record Drawings where Architect determines that neither the original Contract Drawings nor Shop Drawings are suitable to show actual installation.

1. New Drawings may be required when a Change Order is issued as a result of accepting an alternate, substitution, or other modification.
2. Consult Architect for proper scale and scope of detailing and notations required to record the actual physical installation and its relation to other construction. Integrate newly prepared Record Drawings into Record Drawing sets; comply with procedures for formatting, organizing, copying, binding, and submitting.

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

1. Record Prints: Organize Record Prints and newly prepared Record Drawings into manageable sets. Bind each set with durable paper cover sheets. Include identification on cover sheets.
2. Record Transparencies: Organize into unbound sets matching Record Prints. Place transparencies in durable tube-type drawing containers with end caps. Mark end cap of each container with identification. If container does not include a complete set, identify Drawings included.
3. Record CAD Drawings: Organize CAD information into separate electronic files that correspond to each sheet of the Contract Drawings. Name each file with the sheet identification. Include identification in each CAD file.
4. Identification: As follows:

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

2.2 RECORD SPECIFICATIONS

A. Preparation: Mark Specifications to indicate the actual product installation where installation varies from that indicated in Specifications, addenda, and contract modifications.

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1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
2. Mark copy with the proprietary name and model number of products, materials, and equipment furnished, including substitutions and product options selected.
3. Record the name of manufacturer, supplier, Installer, and other information necessary to provide a record of selections made.
4. For each principal product, indicate whether Record Product Data has been submitted in operation and maintenance manuals instead of submitted as Record Product Data.
5. Note related Change Orders, Record Product Data, and Record Drawings where applicable.

2.3 RECORD PRODUCT DATA

A. Preparation: Mark Product Data to indicate the actual product installation where installation varies substantially from that indicated in Product Data submittal.

1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
2. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.
3. Note related Change Orders, Record Specifications, and Record Drawings where applicable.

2.4 MISCELLANEOUS RECORD SUBMITTALS

A. Assemble miscellaneous records required by other Specification Sections for miscellaneous record keeping and submittal in connection with actual performance of the Work. Bind or file miscellaneous records and identify each, ready for continued use and reference.

PART 3 - EXECUTION

3.1 RECORDING AND MAINTENANCE

A. Recording: Maintain one copy of each submittal during the construction period for Project Record Document purposes. Post changes and modifications to Project Record Documents as they occur; do not wait until the end of Project.

B. Maintenance of Record Documents and Samples: Store Record Documents and Samples in the field office apart from the Contract Documents used for construction. Do not use Project Record Documents for construction purposes. Maintain Record Documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to Project Record Documents for Architect's reference during normal working hours.

END OF SECTION 017839

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SECTION 033000 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section specifies cast-in place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes, for the following:

1. Footings.
2. Foundation walls.
3. Slabs-on-grade.

B. Related Sections include the following:

1. Division 31 Section "Earth Moving" for drainage fill under slabs-on-grade.
2. Division 32 Section "Concrete Paving" for concrete pavement and walks.
3. Division 26 Sections for lighting bases.

1.3 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: cement, fly ash or ground granulated blast-furnace slag; subject to compliance with requirements.

1.4 SUBMITTALS

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

B. Design Mixtures: For each concrete mixture. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

1. Indicate amounts of mixing water to be withheld for later addition at Project site.

C. Steel Reinforcement Shop Drawings: Placing drawings that detail fabrication, bending, and placement. Include bar sizes, lengths, material, grade, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, splices and laps, mechanical connections, tie spacing, hoop spacing, and supports for concrete reinforcement.

D. Welding certificates.

E. Qualification Data: For Installer, manufacturer and testing agency.

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F. Material Test Reports: For the following, from a qualified testing agency, indicating compliance with requirements:

1. Aggregates. Include service record data indicating absence of deleterious expansion of concrete due to alkali aggregate reactivity.

G. Material Certificates: For each of the following, signed by manufacturers:

1. Cementitious materials.
2. Admixtures.
3. Form materials and form-release agents.
4. Steel reinforcement and accessories.
5. Fiber reinforcement.
6. Curing compounds.
7. Floor and slab treatments.
8. Bonding agents.
9. Adhesives.
10. Vapor retarders.
11. Semirigid joint filler.
12. Joint-filler strips.
13. Repair materials.

H. Floor surface flatness and levelness measurements to determine compliance with specified tolerances.

I. Field quality-control test and inspection reports.

J. Minutes of preinstallation conference.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who employs on Project personnel qualified as ACI-certified Flatwork Technician and Finisher and a supervisor who is an ACI-certified Concrete Flatwork Technician.

B. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.

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

C. Testing Agency Qualifications: An independent agency, acceptable to authorities having jurisdiction, qualified according to ASTM C 1077 and ASTM E 329 for testing indicated, as documented according to ASTM E 548.

1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-01 or an equivalent certification program.
2. Personnel performing laboratory tests shall be ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician - Grade I. Testing Agency laboratory supervisor shall be an ACI-certified Concrete Laboratory Testing Technician - Grade II.

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D. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from one source, and obtain admixtures through one source from a single manufacturer.

E. Welding: Qualify procedures and personnel according to AWS D1.4, "Structural Welding Code--Reinforcing Steel."

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

1. ACI 301, "Specification for Structural Concrete," Sections 1 through 5.
2. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."

G. Concrete Testing Service: Engage a qualified independent testing agency to perform material evaluation tests and to design concrete mixtures.

H. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."

1. Before submitting design mixtures, review concrete design mixture and examine procedures for ensuring quality of concrete materials. Require representatives of each entity directly concerned with cast-in-place concrete to attend, including the following:

a. Contractor's superintendent.
b. Independent testing agency responsible for concrete design mixtures.
c. Ready-mix concrete manufacturer.
d. Concrete subcontractor.

2. Review special inspection and testing and inspecting agency procedures for field quality control, concrete finishes and finishing, cold- and hot-weather concreting procedures, curing procedures, construction contraction and isolation joints, and joint-filler strips, semirigid joint fillers, forms and form removal limitations, vapor-retarder installation, anchor rod and anchorage device installation tolerances, steel reinforcement installation, floor and slab flatness and levelness measurement, concrete repair procedures, and concrete protection.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

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

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2. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 FORM-FACING MATERIALS

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

1. Plywood, metal, or other approved panel materials.
2. Exterior-grade plywood panels, suitable for concrete forms, complying with DOC PS 1, and as follows:

a. High-density overlay, Class 1 or better.
b. Medium-density overlay, Class 1 or better; mill-release agent treated and edge sealed.
c. Structural 1, B-B or better; mill oiled and edge sealed.
d. B-B (Concrete Form), Class 1 or better; mill oiled and edge sealed.

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

C. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch, minimum.

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

1. Formulate form-release agent with rust inhibitor for steel form-facing materials.

E. Form Ties: Factory-fabricated, removable or snap-off metal or glass-fiber-reinforced plastic form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.

1. Furnish units that will leave no corrodible metal closer than 1 inch to the plane of exposed concrete surface.

2.3 STEEL REINFORCEMENT

A. Recycled Content of Steel Products: Provide products with an average recycled content of steel products so postconsumer recycled content plus one-half of preconsumer recycled content is not less than 25 percent.

B. Reinforcing Bars: ASTM A 615/A 615M, Grade 60, deformed.

C. Plain-Steel Wire: ASTM A 82, as drawn.

D. Plain-Steel Welded Wire Reinforcement: ASTM A 185, plain, fabricated from as-drawn steel wire into flat sheets.

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2.4 REINFORCEMENT ACCESSORIES

A. Joint Dowel Bars: ASTM A 615/A 615M, Grade 60, plain-steel bars, cut bars true to length with ends square and free of burrs.

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

1. For concrete surfaces exposed to view where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire or CRSI Class 2 stainless-steel bar supports.

2.5 CONCRETE MATERIALS

A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source, throughout Project:

1. Portland Cement: ASTM C 150, Type I/II. Supplement with the following:

a. Fly Ash: ASTM C 618, Class F.
b. Ground Granulated Blast-Furnace Slag: ASTM C 989, Grade 100 or 120.

B. Normal-Weight Aggregates: ASTM C 33, Class 1N coarse aggregate or better, graded. Provide aggregates from a single source with documented service record data of at least 10 years' satisfactory service in similar applications and service conditions using similar aggregates and cementitious materials.

1. Maximum Coarse-Aggregate Size 3/4 inch nominal.
2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

C. Water: ASTM C 94/C 94M and potable.

2.6 ADMIXTURES

A. Air-Entraining Admixture: ASTM C 260.

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

1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
2. Retarding Admixture: ASTM C 494/C 494M, Type B.
3. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
4. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
6. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.

C. Set-Accelerating Corrosion-Inhibiting Admixture: Commercially formulated, anodic inhibitor or mixed cathodic and anodic inhibitor; capable of forming a protective barrier and minimizing

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chloride reactions with steel reinforcement in concrete and complying with ASTM C 494/C 494M, Type C.

1. Available Products:

a. Boral Material Technologies, Inc.; Boral BCN.
b. Euclid Chemical Company (The); Eucon CIA.
c. Grace Construction Products, W. R. Grace & Co.; DCI.
d. Master Builders, Inc.; Rheocrete CNI.
e. Sika Corporation; Sika CNI.

D. Non-Set-Accelerating Corrosion-Inhibiting Admixture: Commercially formulated, non-set-accelerating, anodic inhibitor or mixed cathodic and anodic inhibitor; capable of forming a protective barrier and minimizing chloride reactions with steel reinforcement in concrete.

1. Available Products:

a. Axim Concrete Technologies; Catexol 1000CI.
b. Boral Material Technologies, Inc.; Boral BCN2.
c. Cortec Corporation; MCI [2000] [2005NS].
d. Grace Construction Products, W. R. Grace & Co.; DCI-S.
e. Master Builders, Inc.; Rheocrete 222+.
f. Sika Corporation; FerroGard-901.

2.7 FIBER REINFORCEMENT

A. Carbon-Steel Fiber: ASTM A 820, deformed, minimum of 1.5 inches, and aspect ratio of 45 to 50.

1. Available Products:

a. Bekaert Corporation; Dramix.
b. Fibercon International, Inc.; Fibercon.
c. SI Concrete Systems; Zorex.

2. Fiber: Type 1, cold-drawn wire or 2, cut sheet.

2.8 VAPOR RETARDERS

A. Plastic Vapor Retarder: ASTM E 1745, Class A. Include manufacturer's recommended adhesive or pressure-sensitive tape.

1. Available Products:
a. Raven Industries Inc.; Vapor Block 15.
b. Reef Industries, Inc.; Griffolyn Type-65G 15 mil.
c. Stego Wrap Vapor Barrier 15 mil.

B. Fine-Graded Granular Material: Clean mixture of crushed stone, crushed gravel, and manufactured or natural sand; ASTM D 448, Size 10, with 100 percent passing a 3/8-inch sieve, 10 to 30 percent passing a No. 100 sieve, and at least 5 percent passing No. 200 sieve; complying with deleterious substance limits of ASTM C 33 for fine aggregates.

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2.9 FLOOR AND SLAB TREATMENTS

A. Penetrating Liquid Floor Treatment: Clear, chemically reactive, waterborne solution of inorganic silicate or siliconate materials and proprietary components; odorless; colorless; that penetrates, hardens, and densifies concrete surfaces.

1. Available Products:

a. Burke by Edoco; Titan Hard.
b. ChemMasters; Chemisil Plus.
c. ChemTec International; ChemTec One.
d. Conspec Marketing & Manufacturing Co., Inc., a Dayton Superior Company; Intraseal.
e. Curecrete Distribution Inc.; Ashford Formula.
f. Dayton Superior Corporation; Day-Chem Sure Hard.
g. Euclid Chemical Company (The); Euco Diamond Hard.
h. Kaufman Products, Inc.; SureHard.
i. L&M Construction Chemicals, Inc.; Seal Hard.
j. Meadows, W. R., Inc.; Liqui-Hard.
k. Metalcrete Industries; Floorsaver.
l. Nox-Crete Products Group, Kinsman Corporation; Duranox.
m. Symons Corporation, a Dayton Superior Company; Buff Hard.
n. US Mix Products Company; US Spec Industraseal.
o. Vexcon Chemicals, Inc.; Vexcon StarSeal PS.

2.10 CURING MATERIALS

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

1. Available Products:

a. Axim Concrete Technologies; Cimfilm.
b. Burke by Edoco; BurkeFilm.
c. ChemMasters; Spray-Film.
d. Conspec Marketing & Manufacturing Co., Inc., a Dayton Superior Company; Aquafilm.
e. Dayton Superior Corporation; Sure Film.
f. Euclid Chemical Company (The); Eucobar.
g. Kaufman Products, Inc.; Vapor Aid.
h. Lambert Corporation; Lambco Skin.
i. L&M Construction Chemicals, Inc.; E-Con.
j. MBT Protection and Repair, Div. of ChemRex; Confilm.
k. Meadows, W. R., Inc.; Sealtight Evapre.
l. Metalcrete Industries; Waterhold.
m. Nox-Crete Products Group, Kinsman Corporation; Monofilm.
n. Sika Corporation, Inc.; SikaFilm.
o. Symons Corporation, a Dayton Superior Company; Finishing Aid.
p. Unitex; Pro-Film.
q. US Mix Products Company; US Spec Monofilm ER.
r. Vexcon Chemicals, Inc.; Certi-Vex EnvioAssist.

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

C. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.

D. Water: Potable.

E. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, dissipating.

1. Available Products:

a. Anti-Hydro International, Inc.; AH Curing Compound #2 DR WB.
b. Burke by Edoco; Aqua Resin Cure.
c. ChemMasters; Safe-Cure Clear.
d. Conspec Marketing & Manufacturing Co., Inc., a Dayton Superior Company; W.B. Resin Cure.
e. Dayton Superior Corporation; Day Chem Rez Cure (J-11-W).
f. Euclid Chemical Company (The); Kurez DR VOX.
g. Kaufman Products, Inc.; Thinfilm 420.
h. Lambert Corporation; Aqua Kure-Clear.
i. L&M Construction Chemicals, Inc.; L&M Cure R.
j. Meadows, W. R., Inc.; 1100 Clear.
k. Nox-Crete Products Group, Kinsman Corporation; Resin Cure E.
l. Symons Corporation, a Dayton Superior Company; Resi-Chem Clear Cure.
m. Tamms Industries, Inc.; Horncure WB 30.
n. Unitex; Hydro Cure 309.
o. US Mix Products Company; US Spec Maxcure Resin Clear.
p. Vexcon Chemicals, Inc.; Certi-Vex Enviocure 100.

F. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, nondissipating, certified by curing compound manufacturer to not interfere with bonding of floor covering.

1. Available Products:

a. Anti-Hydro International, Inc.; AH Clear Cure WB.
b. Burke by Edoco; Spartan Cote WB II.
c. ChemMasters; Safe-Cure & Seal 20.
d. Conspec Marketing & Manufacturing Co., Inc., a Dayton Superior Company; Cure and Seal WB.
e. Dayton Superior Corporation; Safe Cure and Seal (J-18).
f. Euclid Chemical Company (The); Aqua Cure VOX.
g. Kaufman Products, Inc.; Cure & Seal 309 Emulsion.
h. Lambert Corporation; Glazecote Sealer-20.
i. L&M Construction Chemicals, Inc.; Dress & Seal WB.
j. Meadows, W. R., Inc.; Vocomp-20.
k. Metalcrete Industries; Metcure.
l. Nox-Crete Products Group, Kinsman Corporation; Cure & Seal 150E.
m. Symons Corporation, a Dayton Superior Company; Cure & Seal 18 Percent E.
n. Tamms Industries, Inc.; Clearseal WB 150.
o. Unitex; Hydro Seal.
p. US Mix Products Company; US Spec Hydrasheen 15 percent
q. Vexcon Chemicals, Inc.; Starseal 309.

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G. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, 18 to 25 percent solids, nondissipating, certified by curing compound manufacturer to not interfere with bonding of floor covering.

1. Available Products:

a. Burke by Edoco; Spartan Cote WB II 20 Percent.
b. ChemMasters; Safe-Cure Clear.
c. Conspec Marketing & Manufacturing Co., Inc., a Dayton Superior Company; High Seal.
d. Dayton Superior Corporation; Safe Cure and Seal (J-19).
e. Euclid Chemical Company (The); Diamond Clear VOX.
f. Kaufman Products, Inc.; SureCure Emulsion.
g. Lambert Corporation; Glazecote Sealer-20.
h. L&M Construction Chemicals, Inc.; Dress & Seal WB.
i. MBT Protection and Repair, Div. of ChemRex; MasterKure-N-Seal VOC.
j. Meadows, W. R., Inc.; Vocomp-20.
k. Metalcrete Industries; Metcure 0800.
l. Nox-Crete Products Group, Kinsman Corporation; Cure & Seal 200E.
m. Sonneborn, Div. of ChemRex; Kure-N-Seal.
n. Symons Corporation, a Dayton Superior Company; Cure & Seal 18 Percent E.
o. Tamms Industries, Inc.; Clearseal WB STD.
p. Unitex; Hydro Seal 18.
q. US Mix Products Company; US Spec Radiance UV-25
r. Vexcon Chemicals, Inc.; Starseal 0800.

H. Clear, Waterborne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type 1, Class A.

1. Available Products:

a. Burke by Edoco; Cureseal 1315 WB.
b. ChemMasters; Polyseal WB.
c. Conspec Marketing & Manufacturing Co., Inc., a Dayton Superior Company; Sealcure 1315 WB.
d. Euclid Chemical Company (The); Super Diamond Clear VOX.
e. Kaufman Products, Inc.; Sure Cure 25 Emulsion.
f. Lambert Corporation; UV Safe Seal.
g. L&M Construction Chemicals, Inc.; Lumiseal WB Plus.
h. Meadows, W. R., Inc.; Vocomp-30.
i. Metalcrete Industries; Metcure 30.
j. Symons Corporation, a Dayton Superior Company; Cure & Seal 31 Percent E.
k. Tamms Industries, Inc.; LusterSeal WB 300.
l. Unitex; Hydro Seal 25.
m. US Mix Products Company; US Spec Radiance UV-25.
n. Vexcon Chemicals, Inc.; Vexcon Starseal 1315.

2.11 RELATED MATERIALS

A. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber or ASTM D 1752, cork or self-expanding cork.

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B. Semirigid Joint Filler: Two-component, semirigid, 100 percent solids, epoxy resin with a Type A shore durometer hardness of 80 per ASTM D 2240.

C. Bonding Agent: ASTM C 1059, Type II, non-redispersible, acrylic emulsion or styrene butadiene.

D. Epoxy Bonding Adhesive: ASTM C 881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class suitable for application temperature and of grade to suit requirements, and as follows:

1. Types I and II, non-load bearing, IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.

2.12 REPAIR MATERIALS

A. Repair Underlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch and that can be feathered at edges to match adjacent floor elevations.

1. Cement Binder: ASTM C 150, Portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
2. Primer: Product of underlayment manufacturer recommended for substrate, conditions, and application.
3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by underlayment manufacturer.
4. Compressive Strength: Not less than 4100 psi at 28 days when tested according to ASTM C 109/C 109M.

B. Repair Overlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch and that can be feathered at edges to match adjacent floor elevations.

1. Cement Binder: ASTM C 150, Portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
2. Primer: Product of topping manufacturer recommended for substrate, conditions, and application.
3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by topping manufacturer.
4. Compressive Strength: Not less than 5000 psi at 28 days when tested according to ASTM C 109/C 109M.

2.13 CONCRETE MIXTURES, GENERAL

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

1. Use a qualified independent testing agency for preparing and reporting proposed mixture designs based on laboratory trial mixtures.

B. Cementitious Materials: Use fly ash or ground granulated blast-furnace slag as needed to reduce the total amount of Portland cement, which would otherwise be used, by not less than

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40 percent. Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:

1. Fly Ash: 25 percent.
2. Ground Granulated Blast-Furnace Slag: 50 percent.

C. Limit water-soluble, chloride-ion content in hardened concrete to 0.06 percent by weight of cement.

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

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

2.14 CONCRETE MIXTURES FOR BUILDING ELEMENTS

A. Footings and Foundation Walls: Proportion normal-weight concrete mixture as follows:

1. Minimum Compressive Strength: 4000 psi at 28 days.
2. Maximum Water-Cementitious Materials Ratio: 0.45.
3. Slump Limit: 4 inches for concrete with verified slump of 2 to 4 inches before adding high-range water-reducing admixture or plasticizing admixture, plus or minus 1 inch.
4. Air Content: 6 percent, plus or minus 1.5 percent at point of delivery for 3/4-inch nominal maximum aggregate size.

B. Slabs-on-Grade: Proportion normal-weight concrete mixture as follows:

1. Minimum Compressive Strength: 4000 psi at 28 days.
2. Minimum Cementitious Materials Content: 470 lb/cu. yd.
3. Slump Limit: 4 inches, plus or minus 1 inch.
4. Air Content: 6 percent, plus or minus 1.5 percent at point of delivery for 3/4-inch nominal maximum aggregate size.
5. Air Content: Do not allow air content of troweled finished floors to exceed 3 percent.
6. Steel-Fiber Reinforcement: Add to concrete mixture, according to manufacturer's written instructions, at a rate of 50 lb/cu. yd.

2.15 FABRICATING REINFORCEMENT

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

2.16 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M and furnish batch ticket information.

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

B. Project-Site Mixing: Measure, batch, and mix concrete materials and concrete according to ASTM C 94/C 94M. Mix concrete materials in appropriate drum-type batch machine mixer.

1. For mixer capacity of 1 cu. yd. or smaller, continue mixing at least 1-1/2 minutes, but not more than 5 minutes after ingredients are in mixer, before any part of batch is released.
2. For mixer capacity larger than 1 cu. yd., increase mixing time by 15 seconds for each additional 1 cu. yd.
3. Provide batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, date, mixture type, mixture time, quantity, and amount of water added. Record approximate location of final deposit in structure.

PART 3 - EXECUTION

3.1 FORMWORK

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

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

C. Limit concrete surface irregularities, designated by ACI 347R as abrupt or gradual, as follows:

1. Class A, 1/8 inch for smooth-formed finished surfaces.
2. Class B, 1/4 inch for rough-formed finished surfaces.

D. Construct forms tight enough to prevent loss of concrete mortar.

E. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.

1. Do not use rust-stained steel form-facing material.

F. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.

G. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.

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

I. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.

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J. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.

K. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.

L. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

3.2 EMBEDDED ITEMS

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

1. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC's "Code of Standard Practice for Steel Buildings and Bridges."
2. Install reglets to receive waterproofing and to receive through-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, shelf angles, and other conditions.
3. Install dovetail anchor slots in concrete structures as indicated.

3.3 REMOVING AND REUSING FORMS

A. General: Formwork for sides of beams, walls, columns, and similar parts of the Work that does not support weight of concrete may be removed after cumulatively curing at not less than 50 deg F for 24 hours after placing concrete, if concrete is hard enough to not be damaged by form-removal operations and curing and protection operations are maintained.

1. Leave formwork for beam soffits, joists, slabs, and other structural elements that supports weight of concrete in place until concrete has achieved at least 70 percent of its 28-day design compressive strength.

B. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material will not be acceptable for exposed surfaces. Apply new form-release agent.

C. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces unless approved by Architect.

3.4 VAPOR RETARDERS

A. Plastic Vapor Retarders: Place, protect, and repair vapor retarders according to ASTM E 1643 and manufacturer's written instructions.

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

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3.5 STEEL REINFORCEMENT

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

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

B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that would reduce bond to concrete.

C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.

1. Weld reinforcing bars according to AWS D1.4, where indicated.

D. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.

E. Install welded wire reinforcement in longest practicable lengths on bar supports spaced to minimize sagging. Lap edges and ends of adjoining sheets at least one mesh spacing. Offset laps of adjoining sheet widths to prevent continuous laps in either direction. Lace overlaps with wire.

3.6 JOINTS

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

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

1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints, unless otherwise indicated. Do not continue reinforcement through sides of strip placements of floors and slabs.
2. Form keyed joints as indicated. Embed keys at least 1-1/2 inches (38 mm) into concrete.
3. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.
4. Space vertical joints in walls beside piers integral with walls, near corners, and in concealed locations where possible.
5. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
6. Use epoxy-bonding adhesive at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

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

1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch. Repeat grooving of contraction joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.
2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- wide joints into concrete when cutting

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action will not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.

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

1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface, unless otherwise indicated.
2. Terminate full-width joint-filler strips not less than 1/2 inch or more than 1 inch below finished concrete surface where joint sealants, specified in Division 07 Section "Joint Sealants," are indicated.
3. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.

E. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or asphalt coat one-half of dowel length to prevent concrete bonding to one side of joint.

3.7 CONCRETE PLACEMENT

A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed.

B. Do not add water to concrete during delivery, at Project site, or during placement unless approved by Architect.

C. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301.

1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.

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

1. Deposit concrete in horizontal layers of depth to not exceed formwork design pressures and in a manner to avoid inclined construction joints.
2. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301.
3. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.

E. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.

1. Consolidate concrete during placement operations so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
2. Maintain reinforcement in position on chairs during concrete placement.

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3. Screed slab surfaces with a straightedge and strike off to correct elevations.
4. Slope surfaces uniformly to drains where required.
5. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing operations.

F. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.

1. When average high and low temperature is expected to fall below 40 deg F for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.
2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.

G. Hot-Weather Placement: Comply with ACI 301 and as follows:

1. Maintain concrete temperature below 90 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

3.8 FINISHING FORMED SURFACES

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

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

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

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

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

1. Smooth-Rubbed Finish: Not later than one day after form removal, moisten concrete surfaces and rub with carborundum brick or another abrasive until producing a uniform color and texture. Do not apply cement grout other than that created by the rubbing process.

D. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent

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formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces, unless otherwise indicated.

3.9 FINISHING FLOORS AND SLABS

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

B. Scratch Finish: While still plastic, texture concrete surface that has been screeded and bull-floated or darbied. Use stiff brushes, brooms, or rakes to produce a profile amplitude of 1/4 inch in 1 direction.

1. Apply scratch finish to surfaces to receive concrete floor toppings or to receive mortar setting beds for bonded cementitious floor finishes.

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

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

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

1. Apply a trowel finish to surfaces exposed to view or to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin-film-finish coating system.
2. Finish surfaces to the following tolerances, according to ASTM E 1155, for a randomly trafficked floor surface:

   a. Specified overall values of flatness, F(F) 35; and of levelness, F(L) 25; with minimum local values of flatness, F(F) 24; and of levelness, F(L) 17; for slabs-on-grade.

3. Finish and measure surface so gap at any point between concrete surface and an unleveled, freestanding, 10-foot- long straightedge resting on 2 high spots and placed anywhere on the surface does not exceed 1/4 inch.

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

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

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

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1. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route. Coordinate required final finish with Architect before application.

3.10 MISCELLANEOUS CONCRETE ITEMS

A. Filling In: Fill in holes and openings left in concrete structures, unless otherwise indicated, after work of other trades is in place. Mix, place, and cure concrete, as specified, to blend with in-place construction. Provide other miscellaneous concrete filling indicated or required to complete the Work.

B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.

C. Equipment Bases, Light Pole Bases and Foundations: Provide machine, lighting and equipment bases and foundations as shown on Drawings. Set anchor bolts for machines and equipment at correct elevations, complying with diagrams or templates from manufacturer furnishing machines and equipment.

3.11 CONCRETE PROTECTING AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 301 for hot-weather protection during curing.

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

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

D. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces.

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

1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:

   a. Water.
   b. Continuous water-fog spray.
   c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.

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

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days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.

a. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive floor coverings.
b. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive penetrating liquid floor treatments.
c. Cure concrete surfaces to receive floor coverings with either a moisture-retaining cover or a curing compound that the manufacturer certifies will not interfere with bonding of floor covering used on Project..

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

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

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

3.12 LIQUID FLOOR TREATMENTS

A. Penetrating Liquid Floor Treatment: Prepare, apply, and finish penetrating liquid floor treatment according to manufacturer's written instructions.

1. Remove curing compounds, sealers, oil, dirt, laitance, and other contaminants and complete surface repairs.
2. Do not apply to concrete that is less than 7 days' old.
3. Apply liquid until surface is saturated, scrubbing into surface until a gel forms; rewet; and repeat brooming or scrubbing. Rinse with water; remove excess material until surface is dry. Apply a second coat in a similar manner if surface is rough or porous.

B. Sealing Coat: Uniformly apply a continuous sealing coat of curing and sealing compound to hardened concrete by power spray or roller according to manufacturer's written instructions.

3.13 JOINT FILLING

A. Prepare, clean, and install joint filler according to manufacturer's written instructions.

1. Defer joint filling until concrete has aged at least one month. Do not fill joints until construction traffic has permanently ceased.

B. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joint clean and dry.

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C. Install semirigid joint filler full depth in saw-cut joints and at least 2 inches deep in formed joints. Overfill joint and trim joint filler flush with top of joint after hardening.

3.14 CONCRETE SURFACE REPAIRS

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

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 Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.

1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch in any dimension in solid concrete, but not less than 1 inch in depth. Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush-coat holes and voids with bonding agent. Fill and compact with patching mortar before bonding agent has dried. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.
2. Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement so that, when dry, patching mortar will match surrounding color. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.
3. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by Architect.

D. 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, crazing 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 a 3/4-inch clearance all around.

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Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mixture 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.

E. Perform structural repairs of concrete, subject to Architect's approval, using epoxy adhesive and patching mortar.

F. Repair materials and installation not specified above may be used, subject to Architect's approval.

3.15 FIELD QUALITY CONTROL

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

B. Inspections:

1. Steel reinforcement placement.
2. Steel reinforcement welding.
3. Headed bolts and studs.
4. Verification of use of required design mixture.
5. Concrete placement, including conveying and depositing.
6. Curing procedures and maintenance of curing temperature.
7. Verification of concrete strength before removal of shores and forms from beams and slabs.

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

1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture exceeding 5 cu. yd., but less than 25 cu. yd., plus one set for each additional 50 cu. yd. or fraction thereof.
2. Slump: ASTM C 143; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
3. Air Content: ASTM C 231, pressure method, for normal-weight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
4. Concrete Temperature: ASTM C 1064; one test hourly when air temperature is 40 deg F and below and when 80 deg F and above, and one test for each composite sample.
5. Unit Weight: ASTM C 567, fresh unit weight of structural lightweight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
6. Compression Test Specimens: ASTM C 31.

   a. Cast and laboratory cure two sets of two standard cylinder specimens for each composite sample.

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7. Compressive-Strength Tests: ASTM C 39; test one set of two laboratory-cured specimens at 7 days and one set of two specimens at 28 days.

   a. Test one set of two field-cured specimens at 7 days and one set of two specimens at 28 days.
   b. A compressive-strength test shall be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.

8. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.
9. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi.
10. Test results shall be reported in writing to Architect, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.
11. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.
12. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42/C 42M or by other methods as directed by Architect.
13. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
14. Correct deficiencies in the Work that test reports and inspections indicate dos not comply with the Contract Documents.

D. Measure floor and slab flatness and levelness according to ASTM E 1155 within 48 hours of finishing.

END OF SECTION 033000

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SECTION 04 22 00 - UNIT MASONRY

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. Concrete masonry units.
2. Mortar and grout.
3. Steel reinforcing bars.
4. Masonry joint reinforcement.
5. Ties and anchors.
6. Embedded flashing.
7. Miscellaneous masonry accessories.
8. Cavity-wall insulation.
9. Flashings and End dams

B. Related Sections:
1. Division 03 Section "Cast-in-Place Concrete" for installing dovetail slots for masonry anchors.
2. Division 05 Section "Structural Steel Framing" for installing anchor sections of adjustable masonry anchors for connecting to structural steel frame.
3. Division 05 Section "Metal Fabrications" for furnishing steel lintels and/or shelf angles for unit masonry.
4. Division 07 Section "Sheet Metal Flashing and Trim" for exposed sheet metal flashing and for furnishing manufactured reglets installed in masonry joints.
5. Division 07 Section for Air, Vapor and/or Water Barrier sections

1.3 DEFINITIONS

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

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

1.4 PERFORMANCE REQUIREMENTS

A. Provide structural unit masonry that develops indicated net-area compressive strengths at 28 days.
1. Determine net-area compressive strength of masonry from average net-area compressive strengths of masonry units and mortar types (unit-strength method) according to Tables 1 and 2 in ACI 530.1/ASCE 6/TMS 602.
2. Determine net-area compressive strength of masonry by testing masonry prisms according to ASTM C 1314.

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1.5 INSPECTION TESTING

A. Contractor to employ an independent agency to provide continuous inspection of all exterior walls, masonry shearwalls and masonry load bearing wall construction, as follows: (Continuous means the Inspector shall be on-site whenever masonry work is in progress.)

1. CMU:
   a. Six weeks prior to delivery of masonry materials to the site, perform the following preliminary tests on the proposed materials.
      1) One test on each type of mortar and grout to be used.
      2) One test for each type and strength of concrete masonry units.
      3) Three prisms for each combination of concrete masonry unit, grout and mortar type.

   b. Submit test results for approval.
   c. During construction, perform tests of three masonry prisms for each 1,500 SF of all wall area or each story, whichever is more frequent. Should there be a change of materials from those tested prior to construction, repeat preliminary testing. Submit results to the Engineer promptly for review and comment.
   d. Submit test results with key plan indicating location test was made.
   e. Perform testing in accordance with the "Specification for the Design and Construction of Load-Bearing Concrete Masonry" and the following:
      1) Mortar and Grout: ASTM C 476.
      2) Concrete Masonry Units: ASTM C 90 and C 145.
      3) Prisms: ASTM C 39; test one prism at 7 days and two at 28 days.

   f. Test prisms of concrete block should have a height to thickness ratio of not less than two, and at least 16" high. The thickness of the prism should be the same thickness as the wall of the structure. The length of the prism should be 16". Where necessary, fill the cells with grout to be used in grouting the standing wall. Test two types of prisms:
      1) Hollow units with flanges only mortared.
      2) Units grouted solid and flanges and webs mortared.

   g. Inspect quality and quantity of all jointing, mortar, flashing, ties, anchors, accessories and reinforcement, including bar sizes, splices, overlaps, etc. Advise on mortar lift and placement, general installation and execution.

1.6 ACTION SUBMITTALS

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

B. Shop Drawings: For the following:

1. Masonry Units: Show sizes, profiles, coursing, and locations of special shapes.
2. Reinforcing Steel: Detail bending and placement of unit masonry reinforcing bars. Comply with ACI 315, "Details and Detailing of Concrete Reinforcement." Show elevations of reinforced walls.

1.7 INFORMATIONAL SUBMITTALS

A. List of Materials Used in Constructing Mockups: List generic product names together with manufacturers, manufacturers' product names, model numbers, lot numbers, batch numbers, source of supply, and other information as required to identify materials used. Include mix proportions for mortar and grout and source of aggregates.

1. Submittal is for information only. Neither receipt of list nor approval of mockup constitutes approval of deviations from the Contract Documents unless such deviations are specifically brought to the attention of Architect and approved in writing.

B. Qualification Data: For testing agency.

C. Material Certificates: For each type and size of the following:
   1. Masonry units.
      a. Include data on material properties and material test reports substantiating compliance with requirements.
      b. For brick, include size-variation data verifying that actual range of sizes falls within specified tolerances.
      c. For exposed brick, include test report for efflorescence according to ASTM C 67.
      d. For surface-coated brick, include test report for durability of surface appearance after 50 cycles of freezing and thawing per ASTM C 67 or a list of addresses of buildings in Project's area where proposed brick has been used successfully and with a history of durability.
      e. For masonry units used in structural masonry, include data and calculations establishing average net-area compressive strength of units.
   2. Cementitious materials. Include brand, type, and name of manufacturer.
   3. Pre-blended, dry mortar mixes. Include description of type and proportions of ingredients.
   4. Grout mixes. Include description of type and proportions of ingredients.
   5. Reinforcing bars.
   6. Joint reinforcement.
   7. Anchors, ties, and metal accessories.

D. Mix Designs: For each type of mortar and grout. Include description of type and proportions of ingredients.
   1. Include test reports for mortar mixes required to comply with property specification. Test according to ASTM C 109/C 109M for compressive strength, ASTM C 1506 for water retention, and ASTM C 91 for air content.
   2. Include test reports, according to ASTM C 1019, for grout mixes required to comply with compressive strength requirement.

E. Statement of Compressive Strength of Masonry: For each combination of masonry unit type and mortar type, provide statement of average net-area compressive strength of masonry units, mortar type, and resulting net-area compressive strength of masonry determined according to Tables 1 and 2 in ACI 530.1/ASCE 6/TMS 602.

F. Cold-Weather and Hot-Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with requirements.

1.8 QUALITY ASSURANCE

A. Testing Agency Qualifications: Qualified according to ASTM C 1093 for testing indicated.

B. Source Limitations for Masonry Units: Obtain exposed masonry units of a uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, from single source from single manufacturer for each product required.

C. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from single manufacturer for each cementitious component and from single source or producer for each aggregate.

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

1.9 DELIVERY, STORAGE, AND HANDLING

A. Store masonry units on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install until they are dry.

B. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.

C. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.

D. Deliver pre-blended, dry mortar mix in moisture-resistant containers designed for use with dispensing silos. Store pre-blended, dry mortar mix in delivery containers on elevated platforms, under cover, and in a dry location or in covered weatherproof dispensing silos.

E. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.10 PROJECT CONDITIONS

A. Protection of Masonry:

During construction, cover tops of walls, projections, and sills with waterproof sheeting at end each day's work. Cover partially completed masonry when construction is not in progress.

1. Extend cover a minimum of 24 inches (600 mm) down both sides of walls and hold cover securely in place.
2. Where one wythe of multi-wythe masonry walls is completed in advance of other wythes, secure cover a minimum of 24 inches (600 mm) down face next to unconstructed wythe and hold cover in place.

B. Do not apply uniform floor or roof loads for at least seven days and concentrated loads for at least ten days after building masonry walls or columns.

C. Stain Prevention:

Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.

1. Protect base of walls from rain-splashed mud and from mortar splatter by spreading coverings on ground and over wall surface.
2. Protect sills, ledges, and projections from mortar droppings.
3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
4. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.

D. Cold-Weather Requirements:

1. Remove any ice or snow formed on masonry bed by carefully applying heat until top surface is dry to the touch.
2. Remove all masonry determined to be frozen or damaged by freezing conditions.
3. Perform the following construction procedures while the work is progressing:
   a. When air temperature is from 40 degrees F to 32 degrees F, heat sand or mixing water to produce mortar temperatures between 40 degrees F and 120 degrees F.
   b. When air temperature is from 32 degrees F to 25 degrees F, heat sand or water to produce mortar temperatures between 40 degrees F and 120 degrees F; maintain temperature of mortar on boards above freezing.
   c. When air temperature is from 25 degrees F to 20 degrees F, heat sand and mixing water to produce mortar temperatures between 40 degrees F and 120 degrees F;

maintain temperature of mortar on boards above freezing; use salamanders or other heat sources on both sides of walls under construction; use wind breaks when wind is in excess of 15 mph.

d. When air temperature is 20 degrees F and below, heat sand and mixing water to produce mortar temperatures between 40 degrees F and 120 degrees F; provide enclosures and auxiliary heat to maintain air temperature above 32 degrees F; do not lay units which have a surface temperature of 20 degrees F.

4. Perform the following protections for completed masonry and masonry not being worked on:
   a. When the mean daily air temperature is from 40 degrees F to 32 degrees F, protect masonry from rain or snow for at least 24 hours by covering with weather-resistive membrane.
   b. When mean daily air temperature is from 32 degrees F to 25 degrees F, completely cover masonry with weather-resistive membrane for at least 24 hours.
   c. When mean daily air temperature is from 25 degrees F to 20 degrees F, completely cover masonry with insulating blankets or similar protection for at least 48 hours.
   d. When mean daily temperature is 20 degrees F and below, maintain masonry temperature above 32 degrees F for 72 hours using enclosures and supplementary heat, electric heating blankets, infrared lamps, or other acceptable methods.
5. Provide a thermometer at all places where masonry work is being installed under the above conditions.
6. Masonry walls shall be shored or braced to maintain stability at all times.

E. Hot-Weather Requirements:

Comply with hot-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.

PART 2 - PRODUCTS

2.1 MASONRY UNITS, GENERAL

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

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

2.2 CONCRETE MASONRY UNITS (CMU)

A. Regional Materials: CMUs shall be manufactured within 500 miles (800 km) of Project site from aggregates and cement that have been extracted, harvested, or recovered, as well as manufactured, within 500 miles (800 km) of Project site

B. Shapes: Provide shapes indicated and as follows, with exposed surfaces matching exposed faces of adjacent units unless otherwise indicated.

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

C. Integral Water Repellent: Provide units made with integral water repellent for exposed units and where indicated.

1. Integral Water Repellent: 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.

   a. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include:

      1) ACM Chemistries; RainBloc.
      2) BASF Aktiengesellschaft; Rheopel Plus.
      3) Grace Construction Products, W. R. Grace & Co. - Conn.; Dry-Block.

D. Hollow Load-Bearing CMU: ASTM C 90, Grade N.

1. Provide lightweight units using ASTM C 331 aggregate for a dry net weight of not more than 105 lbs. per cu. ft.
2. Provide "normal weight" units using ASTM C 33 concrete aggregates for a dry net weight of not less than 125 lbs. per cu. ft.

E. Hollow Non-Load-Bearing CMU: ASTM C 129.

1. Provide lightweight units using ASTM C 331 aggregate for a dry net weight of not more than 105 lbs. per cu. ft.
2. Where shown as "normal weight", provide units using ASTM C 33 concrete aggregates for a dry net weight of not less than 125 lbs. per cu. ft.

F. “Rated" CMU: Provide UL Labeled units, complete with stamp, of proper weight, density and aggregates, complying with codes and ordinances to furnish indicated ratings.

G. Curing:

1. Cure units in a moisture-controlled atmosphere or in an autoclave at normal pressure and temperature to comply with ASTM D 90 Type I requirements; or,
2. Cure units by atmospheric drying for not less than 30 days before installation, to comply with ASTM C 90, Type II requirements.

H. Exposed Face: Provide manufacturer's standard color and texture, unless otherwise indicated.

2.3 CONCRETE AND MASONRY LINTELS

A. General: Provide one of the following:

B. Concrete Lintels: ASTM C 1623, matching CMUs in color, texture, and density classification; and with reinforcing bars indicated. Provide lintels with net-area compressive strength not less than CMUs.

C. Concrete Lintels: Precast or formed-in-place concrete lintels complying with requirements in Division 03 Section "Cast-in-Place Concrete" and with reinforcing bars indicated.

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

1. .

2.4 MORTAR AND GROUT MATERIALS

A. Mortar for Face Brickwork: Factory mixed, waterproofed, range as selected, Flamingo, Glen Gery or Medusa.

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

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

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

E. Masonry Cement: ASTM C 91. Cement shall be white masonry cement conforming with the requirements of Standard Specification for Masonry Cement, ASTM C 91, for Type M, S or N masonry cement, as required, except that it shall contain not more than 0.050% by weight Ferric Oxide (Fe_2O_3)
   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. Provide Lehigh Cement “Iron Clad”; or approved equal.

F. Mortar Cement: ASTM C 1329.

G. Mortar Pigments: Natural and synthetic iron oxides and chromium oxides, compounded for use in mortar mixes and complying with ASTM C 979. Use only pigments with a record of satisfactory performance in masonry mortar.
   1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include:
      a. Davis Colors; True Tone Mortar Colors.
      b. Lanxess Corporation; Bayferrox Iron Oxide Pigments.
      c. Solomon Colors, Inc.; SGS Mortar Colors.

H. Aggregate for Mortar: ASTM C 144.
   1. For mortar that is exposed to view, use washed aggregate consisting of natural sand or crushed stone.
   2. For joints less than 1/4 inch (6 mm) thick, use aggregate graded with 100 percent passing the No. 16 (1.18-mm) sieve.
   3. White-Mortar Aggregates: Natural white sand or crushed white stone.
   4. Colored-Mortar Aggregates: Natural sand or crushed stone of color necessary to produce required mortar color as recommended and approved by the mortar manufacturer so as to exactly match the selected color sample.

I. Aggregate for Grout: ASTM C 404.

J. Cold-Weather Admixture: Nonchloride, noncorrosive, accelerating admixture complying with ASTM C 494/C 494M, Type C, and recommended by manufacturer for use in masonry mortar of composition indicated.
   1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include:
      a. Euclid Chemical Company (The); Accelguard 80.
      b. Grace Construction Products, W. R. Grace & Co. - Conn.; Morset.
      c. Sonneborn Products, BASF Aktiengesellschaft; Trimix-NCA.

K. Water-Repellent Admixture: Liquid water-repellent mortar admixture intended for use with CMUs containing integral water repellent by same manufacturer.
   1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include:
      a. ACM Chemistries; RainBloc for Mortar.
      b. BASF Aktiengesellschaft; Rheopel Mortar Admixture.
      c. Grace Construction Products, W. R. Grace & Co. - Conn.; Dry-Block Mortar Admixture.

L. Waterproofing Admixture: “Hydralite”, “Hydrocide”, or “Omicron”.

M. Cavity Drainage System: Fabricated of high density polyethylene (HDPE), nylon and 100% recycled polyester; thickness to suit cavity size. Provide product with 90% open weave mesh in a dovetail configuration, or similar by approved manufacturer, connected by a continuous bottom strip. Provide manufacturers insect resistant weep vents, 2.5” x 4.0” x 0.5”, as part of system.
   1. Products: “Mortar Net Drainage System” manufactured by Mortar Net USA, Ltd. Or approved equal.

N. Water: Potable.

2.5 REINFORCEMENT

A. Uncoated Steel Reinforcing Bars: ASTM A 615/A 615M or ASTM A 996/A 996M, Grade 60 (Grade 420).

B. Masonry Joint Reinforcement, General: ASTM A 951.
   1. Interior Walls: Mill- galvanized, carbon steel.
   2. Exterior Walls: Hot-dip galvanized, carbon steel.
   3. Wire Size for Side Rods: 9 gauge diameter as required by code.
   4. Wire Size for Cross Rods: 9 gauge diameter as required by code.
   5. Wire Size for Veneer Ties: 9 gauge diameter as required by code.
   6. Spacing of Cross Rods, Tabs, and Cross Ties: Not more than 16 inches (407 mm) o.c.
   7. Provide in lengths of not less than 10 feet (3 m), with prefabricated corner and tee units.

C. Masonry Joint Reinforcement for Single-Wythe Masonry: Ladder or truss type with single pair of side rods at each face shell of hollow masonry units.

D. Masonry Joint Reinforcement for Multiwythe Masonry:
   1. Ladder type with 1 side rod at each face shell of hollow masonry units more than 4 inches (100 mm) wide, plus 2 side rods at each wythe of masonry 4 inches (100 mm) wide or less.
   2. Tab type, either ladder or truss design, with 1 side rod at each face shell of backing wythe and with rectangular tabs sized to extend at least halfway through facing wythe but with at least 5/8-inch (16-mm) cover on outside face.
   3. Adjustable (two-piece) type, either ladder or truss design, with one side rod at each face shell of backing wythe and with separate adjustable ties with pintle-and-eye connections having a maximum adjustment of 1-1/4 inches (32 mm). Size ties to extend at least halfway through facing wythe but with at least 5/8-inch (16-mm) cover on outside face when indicated on drawings.

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

2.6 TIES AND ANCHORS

A. Materials: Provide ties and anchors specified in this article that are made from materials that comply with the following unless otherwise indicated.
   1. Mill-Galvanized, Carbon-Steel Wire: ASTM A 82/A 82M; with ASTM A 641/A 641M, Class 1 coating.
   2. Hot-Dip Galvanized, Carbon-Steel Wire: ASTM A 82/A 82M; with ASTM A 153/A 153M, Class B-2 coating.
   3. Stainless-Steel Wire: ASTM A 580/A 580M, Type 316].
   4. Galvanized Steel Sheet: ASTM A 653/A 653M, Commercial Steel, G60 (Z180) zinc coating.
   5. Steel Sheet, Galvanized after Fabrication: ASTM A 1008/A 1008M, Commercial Steel, with ASTM A 153/A 153M, Class B coating.
   6. Stainless-Steel Sheet: ASTM A 666, Type 304.

7. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
8. Stainless-Steel Bars: ASTM A 276 or ASTM a 666, Type 304.

B. Masonry Cavity / Insulated Wall: Provide integral CMU joint reinforcing with flush welded eyelets equal to basis of design #170 as manufactured by Hohmann & Barnard, Inc. with pintles wire ties. Acceptable manufacturers include Heckman Building Products.

C. Adjustable Anchors for Connecting to Concrete: Provide anchors that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall.
1. Connector Section: Dovetail tabs for inserting into dovetail slots in concrete and attached to tie section; formed from 0.105-inch- (1.52-mm-) thick, steel sheet, galvanized after fabrication.
   a. 0.064-inch- (1.63-mm-) thick, galvanized sheet may be used at interior walls unless otherwise indicated.
2. Tie Section: Triangular-shaped wire tie, sized to extend within 1 inch (25 mm) of masonry face, made from 9 gauge diameter, hot-dip galvanized steel wire. Mill-galvanized wire may be used at interior walls unless otherwise indicated.

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

E. Rigid Anchors: Fabricate from steel bars 1-1/2 inches (38 mm) wide by 1/4 inch (6.35 mm) thick by 24 inches (610 mm) long, with ends turned up 2 inches (51 mm) or with cross pins unless otherwise indicated and/or bent to configuration indicated.
1. Corrosion Protection: Hot-dip galvanized to comply with ASTM A 153/A 153M.

F. Adjustable Masonry-Veneer Anchors:
1. General: Provide anchors that allow vertical adjustment but resist tension and compression forces perpendicular to plane of wall, for attachment over sheathing to wood or metal studs, and as follows:
   a. Structural Performance Characteristics: Capable of withstanding a 100-lbf (445-N) load in both tension and compression without deforming or developing play in excess of 0.05 inch (1.3 mm).
2. Contractor's Option: Unless otherwise indicated, provide any of the following types of anchors:
3. Screw-Attached, Masonry-Veneer Anchors: Units consisting of a wire tie and a metal anchor section.
   a. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include:
      1) Heckmann Building Products Inc.; 213 with 282 or Pos-I-Tie only when detailed on drawing.
      2) Hohmann & Barnard, Inc.; DW-10-X SEAL.
      3) Hohmann & Barnard, Inc, HB-200 Series on solid backup, HB-200X-Series on sheathing.
   b. Wire Ties: Triangular-, rectangular-, or T-shaped wire ties fabricated from 9 gauge diameter, hot-dip galvanized steel wire.
4. Polymer-Coated, Steel Drill Screws for Steel Studs: ASTM C 954 except manufactured with hex washer head and neoprene or EPDM washer, No. 10 (4.83-mm) diameter by length required to penetrate steel stud flange with not less than three exposed threads, and with organic polymer coating with salt-spray resistance to red rust of more than 800 hours per ASTM B 117.
   a. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include:
      1) Screw attachment equal to Hohmann & Barnard, self-drilling, self-tapping screw with optional EPDM sealing washer.

2.7 MISCELLANEOUS ANCHORS

A. Unit Type Inserts in Concrete: Cast-iron or malleable-iron wedge-type inserts.

B. Anchor Bolts: Headed or L-shaped steel bolts complying with ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6); with ASTM A 563 (ASTM A 563M) hex nuts and, where indicated, flat washers; hot-dip galvanized to comply with ASTM A 153/A 153M, Class C; of dimensions indicated.

C. Postinstalled Anchors: Torque-controlled expansion anchors or chemical anchors.
1. Load Capacity: Capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.
2. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B 633 or ASTM F 1941 (ASTM F 1941M), Class Fe/Zn 5 unless otherwise indicated.
3. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 (A1) stainless-steel bolts, ASTM F 593 (ASTM F 738M), and nuts, ASTM F 594 (ASTM F 836M).

2.8 EMBEDDED FLASHING MATERIALS

A. Metal Flashing: Provide metal flashing complying with SMACNA's "Architectural Sheet Metal Manual" and/or Division 07 Section "Sheet Metal Flashing and Trim"" and as follows:
1. Stainless Steel: ASTM A 240/A 240M, Type 304, 0.016 inch (0.40 mm) thick.
2. Copper: ASTM B 370, Temper H00, cold-rolled copper sheet, 16-oz./sq. ft. (4.9-kg/sq. m) weight or 0.0216 inch (0.55 mm) thick or ASTM B 370, Temper H01, high-yield copper sheet, 12-oz./sq. ft. (3.7-kg/sq. m) weight or 0.0162 inch (0.41 mm) thick.
3. Fabricate continuous flashings in sections 96 inches (2400 mm) long minimum, but not exceeding 12 feet (3.7 m). Provide splice plates at joints of formed, smooth metal flashing.
4. Fabricate through-wall metal flashing embedded in masonry from stainless steel and/or copper, with ribs at 3-inch (76-mm) intervals along length of flashing to provide an integral mortar bond where indicated on drawings.
   a. Products: Subject to compliance with requirements, provide the following available products that may be incorporated into the Work include, the following:
      1) Cheney Flashing Company; Cheney Flashing (Dovetail) or Cheney 3-Way Flashing (Sawtooth).
      2) Keystone Flashing Company, Inc.; Keystone 3-Way Interlocking Thruwall Flashing.
      3) Sandell Manufacturing Co., Inc.; Mechanically Keyed Flashing.
5. Fabricate through-wall flashing with snaplock receiver on exterior face where indicated to receive counterflashing.
6. Fabricate through-wall flashing with drip edge where indicated. Fabricate by extending flashing 1/2 inch (13 mm) out from wall, with outer edge bent down 30 degrees and hemmed.
7. Fabricate through-wall flashing with sealant stop where indicated. Fabricate by bending metal back on itself 3/4 inch (19 mm) at exterior face of wall and down into joint 1/4 inch (6 mm) to form a stop for retaining sealant backer rod.
8. Fabricate metal drip edges and sealant stops for ribbed metal flashing from plain metal flashing of same metal as ribbed flashing and extending at least 3 inches (76 mm) into wall with hemmed inner edge to receive ribbed flashing and form a hooked seam. Form hem on upper surface of metal so that completed seam will shed water.
9. Metal Drip Edge: Fabricate from stainless steel. Extend at least 3 inches (76 mm) into wall and 1/2 inch (13 mm) out from wall, with outer edge bent down 30 degrees and hemmed.
10. Metal Sealant Stop: Fabricate from stainless steel. Extend at least 3 inches (76 mm) into wall and out to exterior face of wall. At exterior face of wall, bend metal back on itself for 3/4 inch (19 mm) and down into joint 1/4 inch (6 mm) to form a stop for retaining sealant backer rod.

11. Metal Expansion-Joint Strips: Fabricate from stainless steel to shapes indicated. AISI type 302/304 2D finish, fully annealed with dead soft temper, 0.015" thick.

2.9 MISCELLANEOUS MASONRY ACCESSORIES

A. Compressible Filler: Pre-molded filler strips complying with ASTM D 1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from neoprene.

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

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

D. Reinforcing Bar Positioners: Wire units designed to fit into mortar bed joints spanning masonry unit cells and hold reinforcing bars in center of cells. Units are formed from 0.148-inch (3.77-mm) steel wire, hot-dip galvanized after fabrication. Provide units designed for number of bars indicated.
   1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include:
      a. Dayton Superior Corporation, Dur-O-Wal Division; D/A 810, D/A 812 or D/A 817.
      b. Heckmann Building Products Inc.; No. 376 Rebar Positioner.
      c. Hohmann & Barnard, Inc.; #RB or #RB-Twin Rebar Positioner.
      d. Wire-Bond; O-Ring or Double O-Ring Rebar Positioner.

2.10 MASONRY CLEANERS

A. Proprietary Acidic Cleaner: Manufacturer's standard-strength cleaner designed for removing mortar/grout stains, efflorescence, and other new construction stains from new masonry without discoloring or damaging masonry surfaces. Use product expressly approved for intended use by cleaner manufacturer and manufacturer of masonry units being cleaned.
   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include:
      a. Diedrich Technologies, Inc.
      b. EaCo Chem, Inc.
      c. ProSoCo, Inc.

2.11 MORTAR AND GROUT MIXES

A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures, unless otherwise indicated.
   1. Do not use calcium chloride in mortar or grout.
   2. Use portland cement-lime, masonry cement or mortar cement mortar unless otherwise indicated.
   3. For exterior masonry, use portland cement-lime, masonry cement or mortar cement mortar.
   4. For reinforced masonry, use portland cement-lime, masonry cement or mortar cement mortar.
   5. Add cold-weather admixture (if used) at same rate for all mortar that will be exposed to view, regardless of weather conditions, to ensure that mortar color is consistent.

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

C. Mortar for Unit Masonry: Comply with ASTM C 270, Proportion Specification. Provide the following types of mortar for applications stated unless another type is indicated or needed to provide required compressive strength of masonry.
   1. Type M: for masonry below grade and in contact with earth, interior and exterior load bearing walls.
   2. Type S: for exterior above grade non-load-bearing walls.
   3. Type N: for interior non-load-bearing walls.

D. Measure and batch materials either by volume or weight, such that the required proportions for mortar can be accurately controlled and maintained. Measurement of sand exclusively by shovel will not be permitted.

E. To all exterior mortar (except factory mixed waterproofed) add waterproofing admixture in the proportions of one pound per each bag of cement and one pound per each 50 pound bag of hydrated lime in exact accordance with the directions of the manufacturer.

F. Mix mortars with the maximum amount of water consistent with workability to provide maximum tensile bond strength within the capacity of the mortar.

G. Mix mortar ingredients for a minimum of 5 minutes in a mechanical batch mixer. Use water clear and free of deleterious materials which would impair the work. Do not use mortar which has begun to set, or if more than 2-1/2 hours has elapsed since initial mixing. Retemper mortar during 2-1/2 hour period as required to restore workability.

H. Pigmented Mortar: Use colored cement product or select and proportion pigments with other ingredients to produce color required. Do not add pigments to colored cement products.
   1. Pigments shall not exceed 10 percent of portland cement by weight.
   2. Pigments shall not exceed 5 percent of masonry cement or mortar cement by weight.
   3. Mix to match Architect's sample.
   4. Application: Use pigmented mortar for exposed mortar joints with the following units:
      a. Concrete facing brick.
      b. Face brick.
      c. Hollow brick.
      d. Stone trim units.
      e. Cast stone trim units.

I. Colored-Aggregate Mortar: Produce required mortar color by using colored aggregates and natural color or white cement as necessary to produce required mortar color.
   1. Mix to match Architect's sample.
   2. Application: Use colored aggregate mortar for exposed mortar joints with the following units:
      a. Pre-faced CMUs.
      b. Concrete facing brick.
      c. Face brick.
      d. Hollow brick.
      e. Stone trim units.
      f. Cast stone trim units.

J. Grout for Unit Masonry: Comply with ASTM C 476.
   1. Use grout of type indicated or, if not otherwise indicated, of type (fine or coarse) that will comply with Table 1.15.1 in ACI 530.1/ASCE 6/TMS 602 for dimensions of grout spaces and pour height.
   2. Provide grout with a slump of 8 to 11 inches (203 to 279 mm) as measured according to ASTM C 143/C 143M.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
   1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of work.
   2. Verify that foundations are within tolerances specified.
   3. Verify that reinforcing dowels are properly placed.

B. Before installation, examine rough-in and built-in construction for piping systems to verify actual locations of piping connections.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. Thickness: Build cavity and composite walls and other masonry construction to full thickness shown. Build single-wythe walls to actual widths of masonry units, using units of widths indicated.

B. Build chases and recesses to accommodate items specified in this and other Sections.

C. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match the construction immediately adjacent to opening.

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

E. Do not install concrete masonry units with more than 5 percent damage to the face.

F. Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures.
   1. Mix units from several pallets or cubes as they are placed.

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

3.3 TOLERANCES

A. Comply with construction tolerances in ACI 530.1/ASCE 6/TMS 602 and with the following:
   1. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion control joints, do not vary from plumb by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2 inch maximum.
   2. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8 inch in 10 feet, 1/4 in 20 feet, or 1/2 inch maximum.
   3. For dimensions in cross section or elevation do not vary by more than plus 1/2 inch (12 mm) or minus 1/4 inch (6 mm).
   4. For location of elements in plan do not vary from that indicated by more than plus or minus 1/2 inch (12 mm).
   5. For location of elements in elevation do not vary from that indicated by more than plus or minus 1/4 inch (6 mm) in a story height or 1/2 inch (12 mm) total.

B. Lines and Levels:
1. For bed joints and top surfaces of bearing walls do not vary from level by more than 1/4 inch in 10 feet (6 mm in 3 m), or 1/2 inch (12 mm) maximum.
2. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8 inch in 10 feet (3 mm in 3 m), 1/4 inch in 20 feet (6 mm in 6 m), or 1/2 inch (12 mm) maximum.
3. For vertical lines and surfaces do not vary from plumb by more than 1/4 inch in 10 feet (6 mm in 3 m), 3/8 inch in 20 feet (9 mm in 6 m), or 1/2 inch (12 mm) maximum.
4. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8 inch in 10 feet (3 mm in 3 m), 1/4 inch in 20 feet (6 mm in 6 m), or 1/2 inch (12 mm) maximum.
5. For lines and surfaces do not vary from straight by more than 1/4 inch in 10 feet (6 mm in 3 m), 3/8 inch in 20 feet (9 mm in 6 m), or 1/2 inch (12 mm) maximum.
6. For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4 inch in 10 feet (6 mm in 3 m), or 1/2 inch (12 mm) maximum.
7. For faces of adjacent exposed masonry units, do not vary from flush alignment by more than 1/16 inch (1.5 mm) except due to warpage of masonry units within tolerances specified for warpage of units.

C. Joints:
1. For bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch (3 mm), with a maximum thickness limited to 1/2 inch (12 mm).
2. For exposed bed joints, do not vary from bed-joint thickness of adjacent courses by more than 1/8 inch (3 mm) with maximum joint thickness limited to 1/2”.
3. For head and collar joints, do not vary from thickness indicated by more than plus 3/8 inch (9 mm) or minus 1/4 inch (6 mm).
4. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch (3 mm). Do not vary from adjacent bed-joint and head-joint thicknesses by more than 1/8 inch (3 mm).
5. For exposed bed joints and head joints of stacked bond, do not vary from a straight line by more than 1/16 inch (1.5 mm) from one masonry unit to the next.

3.4 LAYING MASONRY WALLS

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

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

C. Lay concealed masonry with all units in a wythe in running bond or bonded by lapping not less than 4-inches (100-mm). Bond and interlock each course of each wythe at corners. Do not use units with less than nominal 4-inch (100-mm) horizontal face dimensions at corners or jambs.

D. Stopping and Resuming Work: Stop work by racking back units in each course from those in course below; do not tooth. When resuming work, clean masonry surfaces that are to receive mortar, remove loose masonry units and mortar, and wet brick if required before laying fresh masonry.

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

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

G. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath, wire mesh, or plastic mesh in the joint below and rod mortar or grout into core.

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

I. Build non-load-bearing interior partitions full height of story to underside of solid floor or roof structure above unless otherwise indicated.
   1. Install compressible filler in joint between top of partition and underside of structure above.
   2. Fasten partition top anchors to structure above and build into top of partition. Grout cells of CMUs solidly around plastic tubes of anchors and push tubes down into grout to provide 1/2-inch (13-mm) clearance between end of anchor rod and end of tube. Space anchors 48 inches (1200 mm) o.c. unless otherwise indicated.
   3. Wedge non-load-bearing partitions against structure above with small pieces of tile, slate, or metal. Fill joint with mortar after dead-load deflection of structure above approaches final position.
   4. At fire-rated partitions, build full-height treat joint between top of partition and underside of structure above to comply with Division 07 Section "Fire-Resistive Joint Systems."

J. Lay hollow concrete masonry units with full mortar coverage on horizontal and vertical face shells; also bed webs in mortar in starting course on footings and foundation walls and in all courses of piers, columns and pilasters, and where adjacent to cells or cavities to be reinforced or to be filled with concrete or grout.
   1. Lay the first course in a full bed of mortar for the full width of the unit; lay the succeeding courses with broken joints. Provide masonry units laid with the cells vertical with bed joints formed by applying the mortar for a width of about one inch to the ends of the adjoining units, laid previously. Smooth the mortar for joints (not furrowed) and of such thickness that it will be forced out of the joints as the units are being placed in position. Where anchors, bolts, reinforcing and ties occur within the cells of the units, fill such cells with grout as the work progresses.

K. Provide deformed reinforcing bars in the cells of masonry units forming the jambs of doors and similar openings, fill completely with grout below lintels as the work progresses, grout the cells of units forming the jambs for a distance of not less than2 feet from the jambs. Lap the bars 12 inches where necessary to facilitate the laying of the units.

L. Where openings are required for mechanical equipment and piping in masonry partitions, install appropriate lintels and sleeves. Fill the spaces between mechanical equipment and piping and the opening with loose fire-resistive mineral fiber and attach a suitable flange to the masonry at both sides of wall to prevent the fill from falling out of spaces.

M. Joints: Maintain joint widths shown, except for minor variations required to maintain bind alignment, but in no case will vertical joints over 1/2 inch or under 1/4 inch be accepted. Drawing dimensions are generally modular. Lay to this module. Lay walls with 3/8” joints. Cut joints flush for masonry walls which are to be concealed or to be covered by other materials, unless otherwise shown.
   1. Concave – “Sled” type jointer, 1/2” round case-hardened or stainless steel, 16 inches minimum length, minimum 1/8” depth from wall face.
   2. Raked – In joints for preparation for application of caulking and sealants, and where shown.

N. Remove masonry units disturbed after laying; clean and relay in fresh mortar. Do not pound corners at jambs to fit stretcher units which have been set in position. If adjustments are required, remove units, clean off mortar, and reset in fresh mortar.

3.5 MORTAR BEDDING AND JOINTING

A. Lay hollow brick and CMUs as follows:
   1. With face shells fully bedded in mortar and with head joints of depth equal to bed joints.
   2. With webs fully bedded in mortar in all courses of piers, columns, and pilasters.
   3. With webs fully bedded in mortar in grouted masonry, including starting course on footings.

4. With entire units, including areas under cells, fully bedded in mortar at starting course on footings where cells are not grouted.

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

C. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.

D. Cut joints flush for masonry walls to receive plaster or other direct-applied finishes (other than paint) unless otherwise indicated.

3.6 CAVITY WALLS

A. Bond wythes of cavity walls together using one of the following methods:
   1. Masonry Joint Reinforcement: Installed in horizontal mortar joints.
      a. Where bed joints of both wythes align, use ladder-type reinforcement extending across both wythes.
      b. Where bed joints of wythes do not align, use adjustable (two-piece) type reinforcement with continuous horizontal wire in facing wythe attached to ties.
      c. Where one wythe is of clay masonry and the other of concrete masonry, use adjustable (two-piece) type reinforcement with continuous horizontal wire in facing wythe attached to ties to allow for differential movement regardless of whether bed joints align.
   2. Masonry Veneer Anchors: Comply with requirements for anchoring masonry veneers.

B. Bond wythes of cavity walls together using bonding system indicated on Drawings.

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

D. Apply air barrier to face of backup wythe to comply with Division 07 Section "Modified Bituminous Sheet Air Barriers or Fluid-Applied Membrane Air Barriers."

E. Installing Cavity-Wall Insulation: Place small dabs of adhesive, spaced approximately 24 inches (600 mm) o.c. both ways, on inside face of insulation boards and as recommended by manufacturer. Fit courses of insulation between wall ties and other confining obstructions in cavity, with edges butted tightly both ways. Press units firmly against inside wythe of masonry or other construction as shown.
   1. Fill cracks and open gaps in insulation with crack sealer and/or low expansion foam compatible with insulation and masonry.
   2. Fill gouges, indentations, and defects with low expansion foam to flush with non damaged insulation.
   3. Request architects review and approval prior to installation of veneer.

3.7 MASONRY JOINT REINFORCEMENT

A. General: Install entire length of longitudinal side rods in mortar with a minimum cover of 5/8 inch (16 mm) on exterior side of walls, 1/2 inch (13 mm) elsewhere. Lap reinforcement a minimum of 6 inches (150 mm).
   1. Space reinforcement not more than 16 inches (406 mm) o.c.
   2. Space reinforcement not more than 8 inches (203 mm) o.c. in foundation walls and parapet walls.
   3. Provide reinforcement not more than 8 inches (203 mm) above and below wall openings and extending 12 inches (305 mm) beyond openings in addition to continuous reinforcement.

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

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

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

E. Cut and bend reinforcing units as directed by manufacturer for continuity at returns, offsets, column fireproofing, pipe enclosures, and other special conditions.

F. Provide continuous horizontal joint reinforcing as shown and specified. Fully embed longitudinal side rods in mortar for their entire length with a minimum cover of 5/8" on exterior side of walls and 1/2" at other locations. Lap reinforcement a minimum of 6" at ends of units. Unless otherwise shown, do not bridge control and expansion joints with reinforcing except at wall openings. Provide continuity at corners and wall intersections by use of prefabricated "L" and "T" sections. Cut and bend units as recommended by manufacturer for continuity at returns, offsets, column fireproofing, pipe enclosures and other special conditions.

G. Spacing:
1. For multi-wythe walls (solid or cavity) where continuous horizontal reinforcing also acts as structural bond or tie between wythes, space reinforcing as required by code but not more than 16" o/c. vertically.
2. For single-wythe walls, space reinforcing at 16" o/c. vertically, unless otherwise indicated.
3. For parapets, space reinforcing at 8" o/c. vertically, unless otherwise indicated.

H. Reinforce masonry openings greater than 1'-0" wide, with horizontal joint reinforcing placed in two horizontal joints approximately 8" apart, both immediately above the lintel and immediately below the sill. Extend reinforcing a minimum of 2'-0" beyond jambs of the opening, bridging control joints where provided. This is in addition to any other wall reinforcing.

3.8 ANCHORING MASONRY TO STRUCTURAL STEEL AND CONCRETE

A. Provide anchoring devices of the type shown and as specified. If not shown or specified, provide standard type for facing and back-up involved.

B. Anchor masonry to structural steel and concrete where masonry abuts or faces structural steel or concrete to comply with the following:
1. Provide an open space not less than 1 inch (25 mm) wide between masonry and structural steel or concrete unless otherwise indicated. Keep open space free of mortar and other rigid materials.
2. Anchor masonry with anchors embedded in masonry joints and attached to structure.
3. Space anchors as indicated, but not more than 24 inches (610 mm) o.c. vertically and 32 inches o.c. horizontally.
4.

C. Anchor single wythe masonry veneer to backing with metal ties as follows:
1. Anchor veneer to structural members with metal anchors embedded in masonry joints and attached to structure. Provide anchors with flexible tie sections, unless otherwise shown.
2. Anchor veneers to concrete back-up with dovetail anchors.
3. Anchor veneers to metal studs as specified in Division 9, therefore, coordinate with the work of that Division.

D. Space veneer anchors as shown, or if not shown, not more than 16" o/c. vertically and 16" o/c. horizontally. Provide additional anchors within 8" of openings and space not more than 3'-0" around perimeter.

3.9 FLASHING, WEEP HOLES, CAVITY DRAINAGE, AND VENTS

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

B. General installation for self-adhering stainless steel flashing:

1. Install where indicated, specified, or required in accord with flashing manufacturer's written instructions and as follows.

2. Splice end joints by overlapping them a minimum of 2” folding flat seam together and seal with a compatible sealant and cover with metal splice tape.

3. Masonry back up:

   a. Surface apply after air/vapor barrier installation specified in Air Barrier Section in accord with manufacturer’s installation instructions

   b. Fasten to masonry back-up surface at top by embedding in layer of sealant or use a non-corrosive termination bar and fasten it to the backer wall at the top edge of the flashing and seal the top edge with compatible sealant or use a termination clamp, which is embedded in the block back up wall

4. Stud back up with sheathing:

   a. Fasten to stud back-up at top by embedding in layer of sealant or use a non-corrosive termination bar and fasten it to the backer wall at the top edge of the flashing and seal the top edge with a compatible sealant

5. Leave ready for certified compatible building felt or air barrier installation lapping flashing top installed in another Section.

6. Fold ends of flashing at end of opening to form dam; seal with polyether sealant or use purchased manufacturers preformed end dams.

7. Inside and outside corners: Make in industry accepted manner using corner and splice material or purchase manufactured corners from manufacturer.

8. Cover flashing within a few days of installation to protect it from damage from the different trades, the environment and falling debris. If flashing is left unprotected and it is punctured, torn, or has loose scrim you should contact the manufacturer for repair instructions.

9. Use stainless steel or copper drip edge any location that the underside of the flashing will be exposed and/or deemed necessary by the design professional or AHJ on the project

C. Install flashing as follows unless otherwise indicated:

1. Prepare masonry surfaces so they are smooth and free from projections that could puncture flashing. Where flashing is within mortar joint, place through-wall flashing on sloping bed of mortar and cover with mortar. Before covering with mortar, seal penetrations in flashing with adhesive, sealant, or tape as recommended by flashing manufacturer.
2. Seal the top vertical leading edge to the exterior face of the interior wythe or sheathing to seal flashing moisture tight to the backup. If not detailed, provide the manufacturer’s recommended termination bar with sealant continuous.
3. At masonry-veneer walls, extend flashing through veneer, across air space behind veneer, and up face of sheathing at least 12 inches (300 mm); with upper edge tucked under building paper or building wrap, lapping at least 4 inches (100 mm) or as indicated on drawings. Provide “zee” metal flashing thru sheathing.
4. At horizontal flashing ends, wall openings, vertical steps, and/or terminations provide end dams by turning up, and folding, the flashing to create a minimum of two inches at the end of the masonry or head joint.

5. Where the horizontal flashing level is shown stepping down or discontinuous, provide continuous flashing vertically or end dams at the horizontal flashing ends. Note that the upper flashing end with end dam is to be extended over the lower horizontal flashing course a minimum of 8” horizontally.
6. At lintels and shelf angles, extend flashing a minimum of 6 inches (150 mm) into masonry at each end. At heads and sills, extend flashing 6 inches (150 mm) at ends and turn up not less than 2 inches (50 mm) to form end dams.
7. Interlock end joints of ribbed sheet metal flashing by overlapping ribs not less than 1-1/2 inches (38 mm) or as recommended by flashing manufacturer, and seal lap with elastomeric sealant complying with requirements in Division 07 Section "Joint Sealants" for application indicated.
8. Install metal drip edges and sealant stops with ribbed sheet metal flashing by interlocking hemmed edges to form hooked seam. Seal seam with elastomeric sealant complying with requirements in Division 07 Section "Joint Sealants" for application indicated.
9. Install where indicated, provide metal drip edges beneath flexible self-adhering flashing at exterior face of wall. Stop flexible composite modified asphalt membrane flashing 1/4inch (13 mm) back from outside face of wall and adhere flexible flashing to top of metal drip edge.
10. Install where indicated, provide metal flashing termination, with exposed drip, beneath flexible self-adhering membrane flashing at exterior face of wall. Stop flexible composite modified asphalt membrane flashing 1/4 inch (13 mm) back from outside face of wall and adhere flexible flashing to top of metal flashing termination.
11. Cut self-adhering stainless steel flashing off flush with face of wall after masonry wall construction is completed.

3.10 REINFORCED UNIT MASONRY INSTALLATION

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

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

C. Grouting: Do not place grout until entire height of masonry to be grouted has attained enough strength to resist grout pressure.
   1. Comply with requirements in ACI 530.1/ASCE 6/TMS 602 for cleanouts and for grout placement, including minimum grout space and maximum pour height.
   2. Limit height of vertical grout pours to not more than 60 inches (1520 mm).

3.11 FIELD QUALITY CONTROL

A. Inspectors: Engage qualified independent inspectors to perform inspections and prepare reports as required herein, State Building Code and as required by the Statement of Special Inspections. Allow inspectors access to scaffolding and work areas, as needed to perform inspections. Place grout only after inspectors have verified compliance of grout spaces and grades, sizes and locations of reinforcement.

B. Testing Agency: Engage a qualified independent testing and inspecting agency to perform field tests and inspections indicated below and prepare test reports for review by Contractor, Architect and/or Special Inspector. Retesting of materials failing to comply with specified requirements shall be done at Contractor’s expense.

C. Testing Frequency: One set of tests for each 5000 sq. ft. of wall area or portion thereof. Test types determined by the independent testing and inspection agency.

D. Special Inspections: Owner may engage a qualified special inspector to prepare reports for authorities having jurisdictions. Allow inspectors access to scaffolding and work areas, as needed to perform inspections. When identified by special inspector, retesting of materials that fail to comply with specified requirements shall be done at Contractor's expense.

E. Inspections: Level 1 or Level 2 special inspections according to the "State Building Code" depending on the special inspection requirements.
   1. Begin masonry construction only after inspectors have verified proportions of site-prepared mortar.
   2. Place grout only after inspectors have verified compliance of grout spaces and of grades, sizes, and locations of reinforcement.
   3. Place grout only after inspectors have verified proportions of site-prepared grout.

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

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

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

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

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

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

L. Prism Test: For each type of construction provided, according to ASTM C 1314 at 7 days and at 28 days.

3.12 MASONRY WASTE DISPOSAL

A. Salvageable Materials: Unless otherwise indicated, excess masonry materials are Contractor's property. At completion of unit masonry work, remove from Project site.

B. Waste Disposal as Fill Material: Dispose of clean masonry waste, including excess or soil-contaminated sand, waste mortar, and broken masonry units, by crushing and mixing with fill material as fill is placed.
   1. Crush masonry waste to less than 4 inches (100 mm) 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 Division 31 Section "Earth Moving."
   3. Do not dispose of masonry waste as fill within 18 inches (450 mm) 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 the project site.

END OF SECTION 04 20 00

SECTION 05 40 00 - COLD-FORMED METAL FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:

1. Exterior non-load-bearing wall framing.
2. Ceiling joist framing.

B. Related Sections include the following:

1. Division 05 Section "Metal Fabrications" for masonry shelf angles and connections.
2. Division 09 Section "Non-Structural Metal Framing" for interior non-load-bearing, metal-stud framing and ceiling-suspension assemblies.
3. Division 13 Section ‘Metal Building System’

1.3 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide cold-formed metal framing capable of withstanding design loads within limits and under conditions indicated.

1. Design Loads: As indicated.
2. Deflection Limits: Design framing systems to withstand design loads without deflections greater than the following:

   a. Exterior Load-Bearing Wall Framing: Horizontal deflection of 1/360 of the wall height, unless indicated otherwise.
   b. Exterior Non-Load-Bearing Framing: Horizontal deflection of 1/360 of the wall height, unless indicated otherwise.

3. Design framing systems to provide for movement of framing members without damage or overstressing, sheathing failure, connection failure, undue strain on fasteners and anchors, or other detrimental effects when subject to a maximum ambient temperature change of 120 deg F.
4. Design framing system to maintain clearances at openings, to allow for construction tolerances, and to accommodate live load deflection of primary building structure as follows:

   a. Upward and downward movement of 3/4 inch.

B. Cold-Formed Steel Framing, General: Design according to AISI's "Standard for Cold-Formed Steel Framing - General Provisions."

1. Headers: Design according to AISI's "Standard for Cold-Formed Steel Framing - Header Design."

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2. Design exterior non-load-bearing wall framing to accommodate horizontal deflection without regard for contribution of sheathing materials.

1.4 SUBMITTALS

A. Product Data: For each type of cold-formed metal framing product and accessory indicated.

B. Shop Drawings: Show layout, spacings, sizes, thicknesses, and types of cold-formed metal framing; fabrication; and fastening and anchorage details, including mechanical fasteners. Show reinforcing channels, opening framing, supplemental framing, strapping, bracing, bridging, splices, accessories, connection details, and attachment to adjoining work.

1. For cold-formed metal framing indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

C. Welding certificates.

D. Qualification Data: For professional engineer and testing agency.

E. Product Test Reports: From a qualified testing agency, unless otherwise stated, indicating that each of the following complies with requirements, based on evaluation of comprehensive tests for current products:

1. Steel sheet.
2. Expansion anchors.
3. Power-actuated anchors.
4. Mechanical fasteners.
5. Vertical deflection clips.
6. Horizontal drift deflection clips
7. Miscellaneous structural clips and accessories.

F. Research/Evaluation Reports: For cold-formed metal framing.

1.5 QUALITY ASSURANCE

A. Engineering Responsibility: Preparation of Shop Drawings, design calculations, and other structural data by a qualified professional engineer.

B. 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 cold-formed metal framing that are similar to those indicated for this Project in material, design, and extent.

C. Testing Agency Qualifications: An independent testing agency, acceptable to authorities having jurisdiction, qualified according to ASTM E 329 to conduct the testing indicated.

D. Product Tests: Mill certificates or data from a qualified independent testing agency[, or in-house testing with calibrated test equipment] indicating steel sheet complies with requirements, including base-metal thickness, yield strength, tensile strength, total elongation, chemical requirements, ductility, and metallic-coating thickness.

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E. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code--Steel," and AWS D1.3, "Structural Welding Code--Sheet Steel."

F. Fire-Test-Response Characteristics: Where indicated, provide cold-formed metal framing identical to that of assemblies tested for fire resistance per ASTM E 119 by a testing and inspecting agency acceptable to authorities having jurisdiction.

G. AISI Specifications and Standards: Comply with AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members" and its "Standard for Cold-Formed Steel Framing - General Provisions."

1. Comply with AISI's "Standard for Cold-Formed Steel Framing - Header Design."

H. Comply with AISI's "Standard for Cold-Formed Steel Framing - Prescriptive Method for One and Two Family Dwellings."

I. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."

1.6 DELIVERY, STORAGE, AND HANDLING

A. Protect cold-formed metal framing from corrosion, deformation, and other damage during delivery, storage, and handling.

B. Store cold-formed metal framing, protect with a waterproof covering, and ventilate to avoid condensation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering cold-formed metal framing that may be incorporated into the Work include, but are not limited to, the following:

1. Allied Studco.
2. AllSteel Products, Inc.
3. California Expanded Metal Products Company.
4. Clark Steel Framing.
5. Consolidated Fabricators Corp.; Building Products Division.
6. Craco Metals Manufacturing, LLC.
7. Custom Stud, Inc.
8. Dale/Incor.
9. Design Shapes in Steel.
10. Dietrich Metal Framing; a Worthington Industries Company.
11. Formetal Co. Inc. (The).
12. Innovative Steel Systems.
13. MarinoWare; a division of Ware Industries.
14. Quail Run Building Materials, Inc.
15. SCAFCO Corporation.
16. Southeastern Stud & Components, Inc.
17. Steel Construction Systems.

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18. Steeler, Inc.
19. Super Stud Building Products, Inc.
20. United Metal Products, Inc.

2.2 MATERIALS

A. Recycled Content of Steel Products: Provide products with an average recycled content of steel products so postconsumer recycled content plus one-half of preconsumer recycled content is not less than 25 percent.

B. Steel Sheet: ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of grade and coating weight as follows:

1. Grade: As required by structural performance.
2. Coating: G60, A60, AZ50, or GF30.

C. Steel Sheet for Vertical Deflection and Drift Clips: ASTM A 653/A 653M, structural steel, zinc coated, of grade and coating as follows:

1. Grade: As required by structural performance.
2. Coating: G90.

2.3 EXTERIOR NON-LOAD-BEARING WALL FRAMING

A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:

1. Minimum Base-Metal Thickness: As indicated on Drawings.
2. Flange Width: 1-5/8 inches.
3. Section Properties: <Insert minimum allowable calculated section modulus, moment of inertia, and allowable moment.>

B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with unstiffened flanges, and as follows:

1. Minimum Base-Metal Thickness: As indicated on Drawings to match steel studs.
2. Flange Width: 1-1/4 inches.

C. Vertical Deflection Clips: Manufacturer's standard bypass or head clips, capable of accommodating upward and downward vertical displacement of primary structure through positive mechanical attachment to stud web.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Dietrich Metal Framing; a Worthington Industries Company.
b. MarinoWare, a division of Ware Industries.
c. SCAFCO Corporation
d. The Steel Network, Inc.

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D. Single Deflection Track: Manufacturer's single, deep-leg, U-shaped steel track; unpunched, with unstiffened flanges, of web depth to contain studs while allowing free vertical movement, with flanges designed to support horizontal and lateral loads and transfer them to the primary structure.

E. Double Deflection Tracks: Manufacturer's double, deep-leg, U-shaped steel tracks, consisting of nested inner and outer tracks; unpunched, with unstiffened flanges.

1. Outer Track: Of web depth to allow free vertical movement of inner track, with flanges designed to support horizontal and lateral loads and transfer them to the primary structure, and as follows:

a. Minimum Base-Metal Thickness: 0.0428 inch.
b. Flange Width: 1 inch plus the design gap for 1-story structures and 1 inch plus twice the design gap for other applications.

2. Inner Track: Of web depth indicated, and as follows:

a. Minimum Base-Metal Thickness: 0.0428 inch.
b. Flange Width: Equal to sum of outer deflection track flange width plus 1 inch.>

F. Drift Clips: Manufacturer's standard bypass or head clips, capable of isolating wall stud from upward and downward vertical displacement and lateral drift of primary structure.

2.4 FRAMING ACCESSORIES

A. Fabricate steel-framing accessories from steel sheet, ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of same grade and coating weight used for framing members.

B. Provide accessories of manufacturer's standard thickness and configuration, unless otherwise indicated, as follows:

1. Supplementary framing.
2. Bracing, bridging, and solid blocking.
3. Web stiffeners.
4. Anchor clips.
5. End clips.
6. Foundation clips.
7. Gusset plates.
8. Stud kickers, knee braces, and girts.
9. Joist hangers and end closures.
10. Hole reinforcing plates.
11. Backer plates.

2.5 ANCHORS, CLIPS, AND FASTENERS

A. Steel Shapes and Clips: ASTM A 36/A 36M, zinc coated by hot-dip process according to ASTM A 123/A 123M.

B. Anchor Bolts: ASTM F 1554, Grade55, threaded carbon-steel hex-headed bolts or headless, hooked bolts and carbon-steel nuts; and flat, hardened-steel washers; zinc coated by hot-dip process according to ASTM A 153/A 153M, Class C.

C. Expansion Anchors: Fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 5 times design load, as determined by testing per ASTM E 488 conducted by a qualified independent testing agency.

D. Power-Actuated Anchors: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 10 times design load, as determined by testing per ASTM E 1190 conducted by a qualified independent testing agency.

E. Mechanical Fasteners: ASTM C 1513, corrosion-resistant-coated, self-drilling, self-tapping steel drill screws.

1. Head Type: Low-profile head beneath sheathing, manufacturer's standard elsewhere.

F. Welding Electrodes: Comply with AWS standards.

2.6 MISCELLANEOUS MATERIALS

A. Galvanizing Repair Paint: SSPC-Paint 20 or DOD-P-21035.

B. Cement Grout: Portland cement, ASTM C 150, Type I; and clean, natural sand, ASTM C 404. Mix at ratio of 1 part cement to 2-1/2 parts sand, by volume, with minimum water required for placement and hydration.

C. Nonmetallic, Nonshrink Grout: Premixed, nonmetallic, noncorrosive, nonstaining grout containing selected silica sands, portland cement, shrinkage-compensating agents, and plasticizing and water-reducing agents, complying with ASTM C 1107, with fluid consistency and 30-minute working time.

D. Shims: Load bearing, high-density multimonomer plastic, nonleaching.

E. Sealer Gaskets: Closed-cell neoprene foam, 1/4 inch thick, selected from manufacturer's standard widths to match width of bottom track or rim track members.

2.7 FABRICATION

A. Fabricate cold-formed metal framing and accessories plumb, square, and true to line, and with connections securely fastened, according to referenced AISI's specifications and standards, manufacturer's written instructions, and requirements in this Section.

1. Fabricate framing assemblies using jigs or templates.
2. Cut framing members by sawing or shearing; do not torch cut.
3. Fasten cold-formed metal framing members by welding, screw fastening, clinch fastening, or riveting as standard with fabricator. Wire tying of framing members is not permitted.

   a. Comply with AWS D1.3 requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
   b. Locate mechanical fasteners and install according to Shop Drawings, with screw penetrating joined members by not less than three exposed screw threads.

4. Fasten other materials to cold-formed metal framing by welding, bolting, or screw fastening, according to Shop Drawings.

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B. Reinforce, stiffen, and brace framing assemblies to withstand handling, delivery, and erection stresses. Lift fabricated assemblies to prevent damage or permanent distortion.

C. Fabrication Tolerances: Fabricate assemblies level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet and as follows:

1. Spacing: Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.
2. Squareness: Fabricate each cold-formed metal framing assembly to a maximum out-of-square tolerance of 1/8 inch.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine supporting substrates and abutting structural framing for compliance with requirements for installation tolerances and other conditions affecting performance.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Before sprayed fire-resistive materials are applied, attach continuous angles, supplementary framing, or tracks to structural members indicated to receive sprayed fire-resistive materials.

B. After applying sprayed fire-resistive materials, remove only as much of these materials as needed to complete installation of cold-formed framing without reducing thickness of fire-resistive materials below that are required to obtain fire-resistance rating indicated. Protect remaining fire-resistive materials from damage.

C. Install load bearing shims or grout between the underside of wall bottom track or rim track and the top of foundation wall or slab at stud or joist locations to ensure a uniform bearing surface on supporting concrete or masonry construction.

D. Install sealer gaskets to isolate the underside of wall bottom track or rim track and the top of foundation wall or slab at stud or joist locations.

3.3 INSTALLATION, GENERAL

A. Cold-formed metal framing may be shop or field fabricated for installation, or it may be field assembled.

B. Install cold-formed metal framing according to AISI's "Standard for Cold-Formed Steel Framing - General Provisions" and to manufacturer's written instructions unless more stringent requirements are indicated.

C. Install shop- or field-fabricated, cold-formed framing and securely anchor to supporting structure.

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1. Screw, bolt, or weld wall panels at horizontal and vertical junctures to produce flush, even, true-to-line joints with maximum variation in plane and true position between fabricated panels not exceeding 1/16 inch.

D. Install cold-formed metal framing and accessories plumb, square, and true to line, and with connections securely fastened.

1. Cut framing members by sawing or shearing; do not torch cut.
2. Fasten cold-formed metal framing members by welding, screw fastening, clinch fastening, or riveting. Wire tying of framing members is not permitted.

a. Comply with AWS D1.3 requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
b. Locate mechanical fasteners and install according to Shop Drawings, and complying with requirements for spacing, edge distances, and screw penetration.

E. Install framing members in one-piece lengths unless splice connections are indicated for track or tension members.

F. Install temporary bracing and supports to secure framing and support loads comparable in intensity to those for which structure was designed. Maintain braces and supports in place, undisturbed, until entire integrated supporting structure has been completed and permanent connections to framing are secured.

G. Do not bridge building expansion and control joints with cold-formed metal framing. Independently frame both sides of joints.

H. Install insulation, specified in Division 07 Section "Thermal Insulation," in built-up exterior framing members, such as headers, sills, boxed joists, and multiple studs at openings, that are inaccessible on completion of framing work.

I. Fasten hole reinforcing plate over web penetrations that exceed size of manufacturer's standard punched openings.

J. Erection Tolerances: Install cold-formed metal framing level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet and as follows:

1. Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.

3.4 EXTERIOR NON-LOAD-BEARING WALL INSTALLATION

A. Install continuous tracks sized to match studs. Align tracks accurately and securely anchor to supporting structure as indicated.

B. Fasten both flanges of studs to top and bottom track, unless otherwise indicated. Space studs as follows:

1. Stud Spacing: As indicated.

C. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar requirements.

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D. Isolate non-load-bearing steel framing from building structure to prevent transfer of vertical loads while providing lateral support.

1. Install single-leg deflection tracks and anchor to building structure.
2. Install double deep-leg deflection tracks and anchor outer track to building structure.
3. Connect vertical deflection clips to [bypassing] [infill] studs and anchor to building structure.
4. Connect drift clips to cold formed metal framing and anchor to building structure.

E. Install horizontal bridging in wall studs, spaced in rows indicated on Shop Drawings but not more than 48 inches apart. Fasten at each stud intersection.

1. Top Bridging for Single Deflection Track: Install row of horizontal bridging within 12 inches of single deflection track. Install a combination of flat, taut, steel sheet straps of width and thickness indicated and stud or stud-track solid blocking of width and thickness matching studs. Fasten flat straps to stud flanges and secure solid blocking to stud webs or flanges.

   a. Install solid blocking at centers indicated.

2. Bridging: Cold-rolled steel channel welded or mechanically fastened to webs of punched studs.
3. Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and stud-track solid blocking of width and thickness to match studs. Fasten flat straps to stud flanges and secure solid blocking to stud webs or flanges.
4. Bridging: Proprietary bridging bars installed according to manufacturer's written instructions.

F. Install miscellaneous framing and connections, including stud kickers, web stiffeners, clip angles, continuous angles, anchors, fasteners, and stud girts, to provide a complete and stable wall-framing system.

3.5 FIELD QUALITY CONTROL

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

B. Field and shop welds will be subject to testing and inspecting.

C. Testing agency will report test results promptly and in writing to Contractor and Architect.

D. Remove and replace work where test results indicate that it does not comply with specified requirements.

E. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.6 REPAIRS AND PROTECTION

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed metal framing with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.

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B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that cold-formed metal framing is without damage or deterioration at time of Substantial Completion.

END OF SECTION 05 40 00

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SECTION 05 50 00 - METAL FABRICATIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

B. DESCRIPTION OF THE WORK:

C. A. The extent of metal fabrication work is shown and includes items fabricated from iron and steel shapes, plates, bars, strips, tubes, pipes and castings which are not part of structural steel or other metal systems in other sections of these specifications. Such work includes but is not limited to:

D. Section Includes:

1. Miscellaneous steel framing and supports.
2. Shelf angles.
3. Metal ladders.
4. Metal grating
5. Abrasive metal nosings and thresholds.
6. Miscellaneous steel trim.
7. Bolts, anchors, nuts, washers, fastening devices, etc.
8. Pipe sleeves not specified in other sections.
9. Miscellaneous structural steel, metals and supports, including shelf angles, loose bearing plates, lintels, steel trim, framing and supports.
10. Floor steel plate.
11. Stainless steel panels for countertops and backsplashes.

E. Products furnished, but not installed, under this Section:

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

1.2 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design ladders, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Structural Performance of Aluminum Ladders: Aluminum ladders, including landings, shall withstand the effects of loads and stresses within limits and under conditions specified in ANSI A14.3.

C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on exterior metal fabrications by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects.

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1. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

1.3 RELATED WORK UNDER OTHER SECTIONS;

A. Structural Steel – Elsewhere in Division 05.

B. Metal Decking – Elsewhere in Division 05.

C. Cold-Formed Metal Framing – Elsewhere in Division 05.

D. Handrails and Railings – Section 055200.

E. Louvers – Division 08 and 23.

1.4 QUALITY ASSURANCE;

A. Code and Standards:

1. AISC "Specifications for the Design, Fabrication, and Erection of Structural Steel for Buildings", including "Commentary of the AISC Specifications".
2. AISC "Specification for the Design of Cold-Formed Steel Structural Members".
3. AWS "Structural Welding Code".

B. Qualification for Welding Work: Qualify welding processes and welding operators in accordance with AWS "Standard Qualification Procedure". Welding operators shall be qualified in accordance with Section 05 of AWS D1.1 Qualification records shall be maintained at the site for review by the Inspection Agency representative and the Architect, when requested.

C. Field Measurements: Take field measurements prior to preparation of shop drawings and fabrication, where possible. Do not delay job progress; allow for trimming and fitting wherever taking field measurements before fabrication might delay work.

D. Inserts and Anchorages: Furnish inserts and anchoring devices which must be set in concrete or built into masonry for installation of miscellaneous metal work. Provide setting drawings, templates, instructions and directions for installation of anchorage devices. Coordinate delivery with other work to avoid delay.

1. See concrete and masonry sections of these specifications for installation inserts and anchorage devices.

E. Shop Assembly: Pre-assemble items in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.

1.5 SUBMITTALS

A. Product Data: For the following:
1. Metal nosings and treads.
2. Paint products.
3. Grout.

B. Manufacturer's Data: For information only, submit copies of manufacturer's specifications, anchor details and installation instructions for products to be used in the fabrication of miscellaneous metal work, including paint products. Transmit copy of instructions to Installer.

C. Shop Drawings: Submit shop drawings for fabrication and erection of miscellaneous metal assemblies. Include plans and elevations at not less than 1" to 1'-0" scale, and include details of sections and connections at not less than 3" to 1'-0" scale. Show anchorage and accessory items. Provide templates for anchor and bolt installation by others.

D. Samples: For each type and finish of extruded nosing and tread.

E. Delegated-Design Submittal: For installed products indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

PART 2 - PRODUCTS

2.1 METALS, GENERAL

A. Metal Surfaces, General: Provide materials with smooth, flat surfaces without blemishes.

2.2 FERROUS METALS

A. Metal Surfaces, General: For fabrication of miscellaneous metal work which will be exposed to view, use only materials which are smooth and free of surface blemishes including pitting, seam marks, roller marks, rolled trades names and roughness.

B. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

C. Stainless-Steel Bars and Shapes: ASTM A 276, Type 304.

D. Rolled-Steel Floor Plate: ASTM A 786/A 786M, rolled from plate complying with ASTM A 36/A 36M or ASTM A 283/A 283M, Grade C or D.

E. Rolled-Stainless-Steel Floor Plate: ASTM A 793.

F. Abrasive-Surface Floor Plate: Steel plate with abrasive material metallically bonded to steel.

G. Steel Tubing: ASTM A 500, cold-formed steel tubing.

H. Steel Pipe: ASTM A 53/A 53M, standard weight (Schedule 40) unless otherwise indicated.

I. Slotted Channel Framing: Cold-formed metal box channels (struts) complying with MFMA-4.

1. Size of Channels: 1-5/8 by 1-5/8 inches and/or as indicated.
2. Material: Galvanized steel, ASTM A 653/A 653M, commercial steel, Type B, with G90 coating; 0.108-inch nominal thickness.
3. Material: Cold-rolled steel, ASTM A 1008/A 1008M, commercial steel, Type B; 0.0966-inch minimum thickness; coated with rust-inhibitive, baked-on, acrylic enamel or hot-dip galvanized after fabrication for exterior applications.

J. Cast Iron: Either gray iron, ASTM A 48/A 48M, or malleable iron, ASTM A 47/A 47M.

2.3 NONFERROUS METALS

A. Aluminum Extrusions: ASTM B 221 (ASTM B 221M), Alloy 6063-T6.

2.4 ANCHORS:

A. Threaded-Type Concrete Inserts: Galvanized ferrous castings, internally threaded to receive 3/4" diameter machine bolts; either malleable iron complying with ASTM A 47 or cast steel complying with ASTM A 27; hot dipped galvanized.

B. Wedge-Type Concrete Inserts: Galvanized box-type ferrous castings, designed to accept 3/4" diameter bolts having special wedge-shaped heads; either malleable iron complying with ASTM A 47 or cast steel complying with ASTM A 27; hot dipped galvanized.

1. Provide carbon steel bolts having special wedge-shaped heads, nuts, washers and shims; all galvanized in compliance with ASTM A 153.

C. Slotted-Type Concrete Inserts: Galvanized 1/8" thick pressed steel plate complying with ASTM A 283; box-type welded construction with slot designed to receive 3/4" diameter square head bolt and with knockout cover; hot dipped galvanized.

2.5 FASTENERS

A. General: Provide zinc-coated fasteners, with galvanizing complying with ASTM A 153, for exterior use or where built into exterior walls. Select fasteners for the type, grade and class required for the installation of miscellaneous metal items.

1. Standard Bolts and Nuts: ASTM A 307, Grade A, regular hexagon head.
2. Lag Bolts: FS FF-B-561, square head type.
3. Machine Screws: FS FF-S-92, cadmium plated steel.
4. Wood Screws: FS FF-S-111, flat head, carbon steel.
5. Plain Washers: FS FF-W-92, round general assembly, grade carbon steel.
6. Lock Washers: FS FF-W-84, helical spring type, carbon steel.
7. Masonry Anchorage Devices: Expansion shields, FS FF-S-325.
8. Toggle Bolts: Tumble-wing type; FS FF-B-588, type, class and style as required.

2.6 PAINT:

A. Metal primer Paint: Primer selected must be compatible with finish coats of paint. Coordinate selection of metal primer with finish paint requirements specified in Division 09.

B. Galvanizing Repair Paint: High zinc dust content paint for regalvanizing welds in galvanized steel, complying with Military Specification MIL-P-21035 (Ships).

1. Product conforming to above specification: ZRC cold galvanizing compound.

C. Where galvanizing prior to completing fabrication cannot be avoided, joints shall be welded after fabrication, ground smooth and finished with four (4) full coats of California Products Corp. WW Totrust, Sealube ZRC, ZIRP by Duncan Galvanizing or approved equal.

2.7 FABRICATION, GENERAL

A. Workmanship: Use materials of size and thickness shown or, if not shown, of required size and thickness to produce strength and durability in finished product. Work to dimensions shown or accepted on shop drawings, using proven details of fabrication and support. Use type of materials shown or specified for various components of work.

B. Shop Assembly: Preassemble items in the shop to greatest extent possible. Use connections that maintain structural value of joined pieces.

C. Form exposed work true to line and level with accurate angles and surfaces and straight sharp edges. Ease exposed edges to a radius of approximately 1/32” unless otherwise shown. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

D. Weld corners and seams continuously, complying with AWS recommendations. Grind exposed welds smooth and flush, to match and blend adjoining surfaces.

E. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners wherever possible. Use exposed fasteners of type shown or, if not shown, Phillips flat-head (countersunk) screws or bolts.

F. Provide for anchorage of type shown, coordinated with supporting structure. Fabricate and space anchoring devices as shown and as required to provide adequate support for intended use.

G. Cut, reinforce, drill and tap miscellaneous metal work as required to receive finish hardware and similar items.

H. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges. Remove sharp or rough areas on exposed surfaces.

I. Galvanizing: provide a hot-dip zinc coating, with the addition of 0.05 – 0.09% Nickel to the zinc bath, for those items supporting or built-into exterior masonry or concrete, steel items exposed to the weather, and other items shown or specified to be galvanized, as follow:

1. ASTM A 153 for galvanizing iron and steel hardware.
2. ASTM A 123 for galvanizing rolled, pressed and forged steel shapes, plate, bars and strip 1/8” thick and heavier.
3. After pickling and prior to galvanizing, the steel shall be immersed in a bath of zinc ammonium chloride. The dry kettle process shall be used to eliminate any flux inclusions on the surface of the galvanized material.

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

K. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors not less than 24 inches o.c.

L. Shop Painting:

1. Shop paint miscellaneous metal work, except members or portions of members to be embedded in concrete or masonry, surfaces and edges to be field welded, and galvanized surfaces, unless otherwise specified.

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2. Remove scale, rust and other deleterious materials before applying shop coat. Clean off heavy rust and loose mill scale in accordance with SSPC SP-2 “Hand Tool Cleaning”, or SSPC SP-3 “Power Tool Cleaning”, or SSPC SP-7 “Brush-off Blast Cleaning”.
3. Remove oil, grease and similar contaminants in accordance with SSPC SP-1 “Solvent Cleaning”.
4. Apply one shop coat of metal primer paint to fabricated metal items, except apply two coats of paint to surfaces inaccessible after assembly or erection. Change color of second coat to distinguish it from the first.
5. Immediately after surface preparation, brush or spray on metal primer paint, applied in accordance with manufacturer’s instructions, and at a rate to provide uniform dry film thickness of 1.5 mils for each coat. Use painting methods which will result in full coverage of joints, corners, edges and exposed surfaces.
6. Where painting of galvanized steel is indicated, provide factory-applied polyamide epoxy primer, 2.0 milsDFT, minimum, in preparation for field applied topcoat. Apply primer within twelve hours after galvanizing at the galvanizer’s plant in a controlled environment meeting applicable environmental regulations, and as recommended by the coating manufacturer.

    a. Provide Duncan PrimerGalv for all galvanized surfaces indicated to be field painted.

7. Shop Marking: When shop markings are utilized on metal items for the convenience of the fabricator, or installer, use marking devices which are compatible to the subsequent paint coatings; otherwise remove markings upon installation and prepare surfaces for their finish coatings.

2.8 MISCELLANEOUS METAL FABRICATIONS:

A. Rough Hardware:

1. Furnish bent or other custom fabricated bolts, plates, anchors, hangers, dowels and other miscellaneous steel and iron shapes as required for framing and supporting woodwork and for anchoring or securing woodwork to concrete or other structures. Straight bolts and other stock rough hardware are specified in Division 06.
2. Manufacture or fabricated items of sizes, shapes and dimensions required. Furnish malleable iron washers for heads and nuts which bear on wood structural connections; elsewhere, furnish steel washers.

B. Loose Bearing Plates:

1. Provide for steel items bearing on masonry or concrete construction, made flat, free from warps or twists, and of required thickness and bearing area, as indicated. Drill plates to receive anchor bolts and for grouting as required. Galvanize after fabrication.

C. Loose Steel Lintels:

1. Provide loose structural steel shape lintels for openings and recesses in masonry walls and partitions as shown. Weld adjoining members together to form a single unit. Provide not less than 6” bearing at each side of openings, unless otherwise shown.

    a. Galvanize loose steel lintels to be installed at exterior walls.

D. Miscellaneous Framing and Supports:

1. Provide miscellaneous steel framing and supports which are not a part of structural steel framework, as required to complete work.
2. Reinforce openings through steel deck, greater than 12” x 12” (144 sq. in.), with angle framing as detailed, and indicated on the Structural Drawings.
3. Fabricate miscellaneous units to sizes, shapes and profiles shown or, if not shown, of required dimensions to receive adjacent other work to be retained by framing. Except as otherwise shown, fabricate from structural steel shapes and plates and steel bars, of welded construction using mitered joints for field connection. Cut, drill and tap units to receive hardware and similar items.
4. Equip units with integrally welded anchor straps for casting into poured concrete or building into masonry wherever required. Furnish inserts if units must be installed after concrete is placed. Except as otherwise shown, space anchors 24” o.c. and provide minimum anchor units of 1-1/4” x 1/4” x 8” steel straps.

    a. Galvanize exterior miscellaneous frames and supports.

5. Miscellaneous Steel trim:

    a. Galvanize exterior miscellaneous steel trim.

2.9 MISCELLANEOUS MATERIALS

A. Low-Emitting Materials: Paints and coatings 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."

B. Shop Primers: Provide primers that comply with Division 09 painting Sections.

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

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

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

F. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

G. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.

H. Concrete: Comply with requirements in Division 03 Section "Cast-in-Place Concrete" for normal-weight, air-entrained, concrete with a minimum 28-day compressive strength of 3000 psi (20 MPa) minimum. First 14 articles below specify fabrication requirements for typical metal fabrications; revise those retained to suit Project and add others as required.

2.10 SHELF ANGLES

A. Fabricate shelf angles from steel angles of sizes indicated and for attachment to concrete framing. Provide horizontally slotted holes to receive 3/4-inch (19 mm) bolts, spaced not more than 6-inches (150 mm) from ends and 24-inches (600 mm) o.c., unless otherwise indicated.

B. For cavity walls, provide vertical channel brackets to support angles from backup masonry and concrete.

C. Galvanize shelf angles located in exterior walls.

D. Furnish wedge-type concrete inserts, complete with fasteners, to attach shelf angles to cast-in-place concrete.

2.11 FRAMING AND SUPPORTS

A. General: Provide steel framing and supports not specified in other Sections as needed to complete the Work.

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

C. Fabricate steel girders for wood frame construction from continuous steel shapes of sizes indicated.

1. Where wood nailers are attached to girders with bolts or lag screws, drill or punch holes at 24 inches o.c.

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

2.12 SHELF ANGLES

A. Fabricate shelf angles from steel angles of sizes indicated and for attachment to concrete framing. Provide horizontally slotted holes to receive 3/4-inch bolts, spaced not more than 6 inches from ends and 24 inches o.c., unless otherwise indicated.

B. For cavity walls, provide vertical channel brackets to support angles from backup masonry and concrete.

C. Galvanize shelf angles located in exterior walls.

D. Prime shelf angles located in exterior walls with primer specified in Division 09 Section "High-Performance Coatings."

E. Furnish wedge-type concrete inserts, complete with fasteners, to attach shelf angles to cast-in-place concrete.

2.13 MISCELLANEOUS STEEL TRIM

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

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

C. Galvanize exterior miscellaneous steel trim.

2.14 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Finish metal fabrications after assembly.

PART 3 - EXECUTION

3.1 INSPECTION:

A. Examine the areas and conditions under which miscellaneous metal items are to be installed. Do not proceed with the work until unsatisfactory conditions have been corrected.

3.2 PREPARATION:

A. Furnish setting drawings, diagrams, templates, instructions, and directions for installation of anchorages, such as concrete inserts, anchor bolts and miscellaneous items having integral anchors, which are to be embedded in concrete or masonry construction. Coordinate delivery of such items to project site.

3.3 INSTALLATION:

A. Setting Loose Bearing Plates:

1. Clean concrete and masonry bearing surfaces of any bond-reducing materials, and roughen to improve bond to surfaces. Clean the bottom surface of bearing plates.
2. Set loose bearing plates on wedges, or other adjustable devices. After the joints have been positioned and plumbed, tighten the anchor bolts. Do not remove wedges or shims, but if protruding, cut-off flush with the edge of the bearing plate before packing with mortar.
3. Pack bedding mortar solidly between bearing surfaces and plates to ensure that no voids remain.

3.4 FASTENING TO IN-PLACE CONSTRUCTION:

A. Provide anchorage devices and fasteners where necessary for securing miscellaneous metal items, including ladder, cages, alternating tread ladders, etc. to in-place construction; using threaded fasteners for concrete and masonry inserts, toggle bolts, through-bolts, wood screws and other connectors as required.

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3.5 CUTTING, FITTING AND PLACEMENT:

A. Perform cutting, drilling and fitting required for installation of miscellaneous metal items. Set work accurately in location, alignment and elevation, plumb, level, true and free of rack, measured from established lines and levels. Provide temporary bracing or anchors in formwork for items which are to be built into concrete, masonry, or similar construction.

B. Fit exposed connections accurately together to form tight hairline joints. Weld connections which are not to be left as exposed joints, but cannot be shop welded because of shipping size limitations. Grind joints smooth and touch-up shop paint coat. Do not weld, cut or abrade the surfaces of exterior units which have been hot-dip galvanized after fabrication, and are intended for bolted or screwed field connections.

3.6 FIELD WELDING:

A. Comply with AWS Code for procedures of manual shielded metal-arc welding, appearance and quality of welds made, and methods used in correcting welding work.

3.7 ADJUSTING AND CLEANING:

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

B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

3.8 TOUCH-UP PAINTING:

A. Cleaning and touch-up painting of field welds, bolted connections and abraded areas of the shop paint on miscellaneous metal is specified in Division 09.

3.9 ADJUSTING AND CLEANING

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

B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

END OF SECTION 05 50 00

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SECTION 06 10 00 - ROUGH CARPENTRY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Materials and installation requirements for other work, commonly assigned to carpentry trade, are specified in other sections of these specifications.

B. The types of carpentry work specified in this section include (but are not necessarily limited to) the following:

1. Wood furring.
2. Wood grounds, nailers, blocking.
3. Miscellaneous wood framing.

C. Fire-retardant treated plywood and lumber.

1.3 SUBMITTALS

A. Wood Treatment Data: For information only, submit chemical treatment manufacturer's instructions for proper use of each type of treated material.

1. Certificate: Pressure Treatment, for each type specified, include certification by treating plant stating chemicals and process used, net amount of salts retained and conformance with applicable standards.
2. For water-borne preservatives, include statement that moisture content of treated materials was reduced to a maximum of 15% prior to shipment to project site.

B. Certificates: Fire-Retardant Treatment, certification by testing plant that treatment material complies with this specification and with all governing regulations, and treatment will not bleed through finished surfaces.

1.4 QUALITY ASSURANCE

A. Testing Agency Qualifications: For testing agency providing classification marking for fire-retardant treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.

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1.5 DELIVERY, STORAGE, AND HANDLING

A. Stack lumber flat with spacers beneath and between each bundle to provide air circulation. Protect lumber from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 WOOD PRODUCTS, GENERAL

A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, provide lumber that complies with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Provide lumber graded by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.

1. Factory mark each piece of lumber with grade stamp of grading agency.
2. For exposed lumber indicated to receive a stained or natural finish, mark grade stamp on end or back of each piece or omit grade stamp and provide certificates of grade compliance issued by grading agency.
3. Where nominal sizes are indicated, provide actual sizes required by DOC PS 20 for moisture content specified. Where actual sizes are indicated, they are minimum dressed sizes for dry lumber.
4. Provide dressed lumber, S4S, unless otherwise indicated.

B. Maximum Moisture Content of Lumber: 15 percent unless otherwise indicated.

2.2 MISCELLANEOUS LUMBER

A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:

1. Provide wood for support or attachment of other work such as cant strips, bucks, nailers, blocking, furring, grounds, stripping and similar members. Provide lumber of sizes shown or specified, worked to shapes shown, and as follows:

   a. Moisture Content: 15% maximum for lumber items not specified to receive wood preservative treatment.

2. Grade: Construction Grade light framing size lumber of any species, or board size lumber, as required. Provide Construction Grade boards (RIS or WCLIB) or No. 2 boards (SPIB or WWPA).

B. For items of dimension lumber size, provide Construction, stud, or No. 2 grade lumber and any of the following species with moisture content not exceeding 15%:

1. Hem-fir (north); NLGA.
2. Mixed southern pine; SPIB.
3. Spruce-pine-fir; NLGA.
4. Hem-fir; WCLIB or WWPA.
5. Spruce-pine-fir (south); NeLMA, WCLIB, or WWPA.
6. Western woods; WCLIB or WWPA.
7. Northern species; NLGA.

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8. Eastern softwoods; NeLMA.

C. For concealed boards, provide lumber with 15 percent maximum moisture content and any of the following species and grades:

1. Mixed southern pine; No. 2 grade; SPIB.
2. Hem-fir or hem-fir (north); Construction or No. 2 Common grade; NLGA, WCLIB, or WWPA.
3. Spruce-pine-fir (south) or spruce-pine-fir; Construction or No. 2 Common grade; NeLMA, NLGA, WCLIB, or WWPA.
4. Eastern softwoods; No. 2 Common grade; NeLMA.
5. Northern species; No. 2 Common grade; NLGA.
6. Western woods; Construction or No. 2 Common grade; WCLIB or WWPA.

D. For blocking not used for attachment of other construction, Utility, Stud, or No. 3 grade lumber of any species may be used provided that it is cut and selected to eliminate defects that will interfere with its attachment and purpose.

E. For blocking and nailers used for attachment of other construction, select and cut lumber to eliminate knots and other defects that will interfere with attachment of other work.

F. For furring strips for installing plywood or hardboard paneling, select boards with no knots capable of producing bent-over nails and damage to paneling.

2.3 FASTENERS

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

1. Where rough carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M.

B. Power-Driven Fasteners: NES NER-272.

C. Bolts: Steel bolts complying with ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6); with ASTM A 563 (ASTM A 563M) hex nuts and, where indicated, flat washers.

D. Expansion Anchors: Anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry assemblies and equal to four times the load imposed when installed in concrete as determined by testing per ASTM E 488 conducted by a qualified independent testing and inspecting agency.

1. Material: Carbon-steel components, zinc plated to comply with ASTM B 633, Class Fe/Zn 5.
2. Material: Stainless steel with bolts and nuts complying with ASTM F 593 and ASTM F 594, Alloy Group 1 or 2 (ASTM F 738M and ASTM F 836M, Grade A1 or A4).

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PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Set rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit rough carpentry to other construction; scribe and cope as needed for accurate fit. Locate furring, nailers, blocking, grounds, and similar supports to comply with requirements for attaching other construction.

B. Framing Standard: Comply with AF&PA's WCD 1, "Details for Conventional Wood Frame Construction," unless otherwise indicated.

C. Install plywood backing panels by fastening to studs; coordinate locations with utilities requiring backing panels. Install fire-retardant treated plywood backing panels with classification marking of testing agency exposed to view.

D. Metal Framing Anchors: Install metal framing anchors to comply with manufacturer's written instructions. Install fasteners through each fastener hole.

E. Install sill sealer gasket to form continuous seal between sill plates and foundation walls.

F. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.

1. Provide metal clips for fastening gypsum board or lath at corners and intersections where framing or blocking does not provide a surface for fastening edges of panels. Space clips not more than 16 inches o.c.

G. Provide fire blocking in furred spaces, stud spaces, and other concealed cavities as indicated and as follows:

1. Fire block furred spaces of walls, at each floor level, at ceiling, and at not more than 96 inches (2438 mm) o.c. with solid wood blocking or noncombustible materials accurately fitted to close furred spaces.
2. Fire block concealed spaces of wood-framed walls and partitions at each floor level, at ceiling line of top story, and at not more than 96 inches (2438 mm) o.c. Where fire blocking is not inherent in framing system used, provide closely fitted solid wood blocks of same width as framing members and 2-inch nominal- (38-mm actual-) thickness.
3. Fire block concealed spaces between floor sleepers with same material as sleepers to limit concealed spaces to not more than 100 sq. ft. (9.3 sq. m) and to solidly fill space below partitions.
4. Fire block concealed spaces behind combustible cornices and exterior trim at not more than 20 feet (6 m) o.c.

H. Comply with AWPA M4 for applying field treatment to cut surfaces of preservative-treated lumber.

1. Use inorganic boron for items that are continuously protected from liquid water.
2. Use copper naphthenate for items not continuously protected from liquid water.

I. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:

1. NES NER-272 for power-driven fasteners.

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2. Table 2304.9.1, "Fastening Schedule," in ICC's International Building Code.
3. Table R602.3(1), "Fastener Schedule for Structural Members," and Table R602.3(2), "Alternate Attachments," in ICC's International Residential Code for One- and Two-Family Dwellings.

J. Use steel common nails unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood. Drive nails snug but do not countersink nail heads unless otherwise indicated.

K. For exposed work, arrange fasteners in straight rows parallel with edges of members, with fasteners evenly spaced, and with adjacent rows staggered.

1. Comply with approved and/or indicated fastener patterns where applicable. Before fastening, mark fastener locations, using a template made of sheet metal, plastic, or cardboard.
2. Use finishing nails unless otherwise indicated. Countersink nail heads and fill holes with wood filler.
3. Use common nails unless otherwise indicated. Drive nails snug but do not countersink nail heads.

3.2 WOOD GROUND, SLEEPER, BLOCKING, AND NAILER INSTALLATION

A. Install where indicated and where required for screeding or attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.

B. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces unless otherwise indicated.

C. Where wood-preservative-treated lumber is installed adjacent to metal decking, install continuous flexible flashing separator between wood and metal decking.

D. Provide permanent grounds of dressed, pressure-preservative-treated, key-beveled lumber not less than 1-1/2 inches (38 mm) wide and of thickness required to bring face of ground to exact thickness of finish material. Remove temporary grounds when no longer required.

E. ROOF BLOCKING FASTENERS

1. All blocking shall be fastened in compliance with the guidelines set-forth in the latest Factory Mutual publications.
2. Fasteners for wood blocking shall be staggered and spaced twelve (12) inches on center. The staggered fastening pattern shall be increased within eight (8) feet from outside corners to six (6) inches on center. Smaller pieces of blocking, such as at penetrations, shall have a minimum of four fasteners per piece. A fastener shall be located no more than four inches from the end of each piece of blocking.
3. Counter bore at all bolt heads, nuts, and washers as may be required to provide a flush surface for installation of new roofing materials.

3.3 WOOD FURRING INSTALLATION

A. Install plumb and level with closure strips at edges and openings. Shim with wood as required.

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1. Firestop furred spaces on walls at each floor level, with wood blocking or incombustible materials, accurately fitted to close furred spaces. Comply with governing regulations.

B. Furring to Receive Gypsum Drywall: Unless otherwise shown, provide 1" x 3" furring at 24" o/c. spacing, in the direction required for support of drywall; refer to Division 9.

C. Suspended Furring: Provide size and spacing shown, including hangers and attachment devices.

D. Tolerance: Shim and level wood furring to a tolerance of 1/8” in 10’-0”, except 1/4” in 10’-0” at thick coat plaster work.

3.4 PROTECTION

A. Protect wood that has been treated with inorganic boron (SBX) from weather. If, despite protection, inorganic boron-treated wood becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

B. Protect rough carpentry from weather. If, despite protection, rough carpentry becomes wet or sufficiently wet that moisture content exceeds that specified, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

END OF SECTION 06 10 00

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SECTION 06 40 00 - ARCHITECTURAL WOODWORK

PART 1 - GENERAL

1.1 SUMMARY

A. The extent of each type of architectural woodwork is shown. Architectural woodwork is defined to include (in addition to items so designated on the drawings) all exterior and interior miscellaneous exposed to view woodwork and wood members commonly known as "Finish Carpentry" or "Millwork", except where specified under another section of these specifications.

B. The types of architectural woodwork include, but are not necessarily limited to, the following:

1. Standing and running trim, window sills, etc.
2. Wood casework.
3. Wood shelving.
4. Plastic laminate.

C. The installation and finishing of architectural woodwork includes, but is not necessarily limited to:

1. Factory finishing of the work in this Section.
2. Shimming, furring and blocking.
3. Installation of the work in this Section.

1.2 RELATED WORK UNDER OTHER SECTIONS:

A. Wood Doors - Division 8.

B. Rough Carpentry - Section 061000.

C. Solid surfacing countertops - Section 066500.

1.3 QUALITY ASSURANCE:

A. Quality Standards: Except as otherwise shown or specified, comply with specified provisions of the following:

1. Architectural Woodwork Institute (AWI) "Quality Standards", current edition.

B. Quality Marking: Mark each unit of architectural woodwork with mill's or fabricator's identification and grade mark, located on surfaces which will not be exposed after installation.

C. Work in this section shall be performed by a firm certified by the Architectural Woodwork Institute (AWI) Quality Certification Program.

D. Work in this section shall comply with the specified grade(s) of work and section(s) of the current edition of the Architectural Woodwork Institute quality standards.

1.4 SUBMITTALS:

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A. Manufacturer's Data: Submit manufacturer's specifications and installation instructions for each item of factory-fabricated woodwork.

1. Shop Drawings: Submit shop drawings of the Work in this Section showing location of each item, dimensioned plans and elevations, large scale details, attachment devices and other components as per AWI Appendix.

B. Samples: Submit the following samples for each species and cut or pattern of architectural woodwork:

1. Wood for transparent finish, set of three pieces, 6" x 3/4" x 2'-0", finished on one side and one edge.
2. Plastic laminate; manufacturer standard chain, minimum twenty (20) colors, not including wood grains or marbles.
3. Exposed cabinet hardware; one unit of each type and finish.
4. Woodwork for transparent finish: Submit range type samples in sets of two or more, illustrating the possible range of the natural characteristics in the species selected for approval. Prefinished samples shall be step-type showing the range from bare wood to the completed finish. Finish steps shall be fully descripted on the manufacturer label.

1.5 PRODUCT DELIVERY, STORAGE AND HANDLING:

A. Protect woodwork during transit, delivery, storage and handling to prevent damage, soiling and deterioration.

B. Do not deliver woodwork, until painting, wet work, grinding and similar operations which could damage, soil or deteriorate woodwork have been completed in installation areas. If, due to unforeseen circumstances, woodwork must be stored in other than installation areas, store only in areas meeting requirements specified for installation areas. Comply with AWI Section 1700-G-3.

1.6 JOB CONDITIONS:

A. Examine the substrates and conditions under which the work is to be installed; and notify the Contractor in writing of unsatisfactory conditions. Do not proceed with the work until unsatisfactory conditions have been corrected.

B. Conditioning: Advise the Contractor of temperature and humidity requirements for woodwork installation areas. Do not install woodwork until the required temperature and relative humidity have been stabilized and will be maintained in installation areas.

C. Maintain temperature and humidity in installation area as required to maintain moisture content of installed woodwork within a 1.0 percent tolerance of the optimum moisture content, from the date of installation through the remainder of the construction period. The fabricator of the woodwork shall determine the optimum moisture content and required temperature and humidity conditions. Comply with AWI Section 1700-G-4.

PART 2 - PRODUCTS

2.1 BASIC MATERIALS AND FABRICATION METHODS:

A. General: Except as otherwise indicated, comply with the following requirements for the Work in this Section:

1. All Work in this Section shall be AWI Premium Grade unless otherwise indicated.

B. Provide materials and workmanship that comply with the requirements of the AWI quality standard for each type of woodwork and quality grade indicated. If the following products are part of the Work in this Section, provide materials that comply with the referenced product standards that apply to the product characteristics indicated.

1. ANSI A208.1 - Wood Particleboard.
2. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
3. AWI QSI Current Edition - Architectural Woodwork Quality Standards Illustrated; Architectural Woodwork Institute.
4. AWPA C2 - Lumber, Timbers, Bridge Ties and Mine Ties - Preservative Treatment by Pressure Processes; American Wood Preservers Association.
5. HPVA HP-1 - Voluntary Standard for Hardwood and Decorative Plywood; Hardwood Plywood and Veneer Association.
6. NIST PS 1 - Construction and Industrial Plywood.
7. NIST PS 20 - American Softwood Lumber Standard.
8. Curved Hardwood Plywood: HPVA HP-1 Grade AA Type II Core Type J; Graded in accordance with AWI Premium; 3/4 inch (19 mm) thick, 7 ply veneer core, consisting of 3 hardwood plies with grain perpendicular to each other and 1/16 inch (1.6 mm) thick crossbands; form continuous curved panel under controlled pressure methods, type of glue recommended for application; Grade AA veneer. Run grain of face and back veneers vertically. Contact cemented or saw-kerfed and bent plywood will NOT be accepted.
9. Fire Retardant Particleboard: ANSI A208.1 Type 1, Fire Retardant, UL Class 1.

C. Wood Moisture Content: Comply with requirements of referenced quality standard for the moisture content of the Work in this Section in relation to relative humidity conditions existing during the time of fabrication and in installation areas; 5% to 10% for interior work and 9% to 15% for exterior work (AWI 100-S-11).

D. Fire Treated Materials and Locations:

1. Fire resistance requirements: Treat those items required to be treated by authorities having jurisdiction over Work, and those items indicated as "Fire Retardant Treated Wood".

2.2 INTERIOR MATERIALS:

A. Wood for Transparent Finish: Provide the species and grade or cut as follows, unless otherwise indicated:

1. Solid Wood: Plain Sliced White Birch.
2. Hardwood Plywood: Plain sliced White Birch. HPVA HP-1 Grade AA Type II; 3/4” thick, balanced construction.

B. Wood for Painted Finish: Closed grain hardwood, any species.

C. Miscellaneous Concealed Materials: Unless specified herein, provide concealed materials, as part of the work of this section, conforming to the following requirements:

1. Softwood: Fir or Pine; 1" nominal thickness unless otherwise shown.
2. Plywood: Fir, DFPA B-B, or better; 3/4" thick, unless shown otherwise.
3. Particleboard: Unless specified otherwise, provide mat-formed, Type 1-B-2 of CS 236; filled ; 3/4" thick unless shown otherwise.
4. Hardboard: Tempered; perforated where so indicated; smooth surface(s) where not concealed; 1/8" minimum thickness except as otherwise specified or shown.

D. Standing and Running Trim: AWI Section 300, Premium grade, transparent finish.

1. If indicated to be painted, provide Custom grade, closed grain hardwood.

a. Fabricate wood trim to dimensions, profiles and details shown. Rout or groove reverse side (backed-out) of trim members to be applied to flat surfaces, except for members with ends exposed in the finished work. Shop fabricate to the greatest extent possible.

E. Shelving for Transparent Finish: (where exposed to view, in public areas, adjacent casework items, coat and hat shelves, and where indicated as "hardwood"):

1. Hardwood plywood, as previously specified.

F. Shelving for Paint Finish: (Concealed; in closets and storage rooms)

1. Quality and Grade: AWI Section 600, Custom Grade.
2. Material: Wood or plywood, capable of supporting 30 pounds per square foot with a 1/4 inch maximum deflection; with metal or wood pole to support 10 pounds per lineal foot with a maximum deflection of 1/4 inch.
3. Edges: Edgeband all exposed edges on fixed shelves and all edges of adjustable shelving.
4. Provide shelf and bracket hardware, coat rod and hooks, where indicated or required.

G. High Pressure Decorative Laminate: NEMA LD 3

1. Manufacturers: (Subject to compliance with requirements)

a. Formica Corporation, Nevamar,
b. Westinghouse Electric Corporation, Specialty Products Division
c. Wilsonart
d. Pionite

H. Casework, General Requirements:

1. Casework Portions: Refer to the definitions in the specified quality standards for the following:

a. Exposed Portions: Provide materials as shown and as further specified.
b. Semi-Exposed Portions: Provide materials as shown and as further specified.
c. Concealed Portions: Provide sound materials of any wood species.

2. Casework Doors: Comply with the thickness and door size limitations of the specified quality standards.

a. Doors larger than 30” wide or 80” high shall be 1-3/8” minimum thickness.

3. Case Hardware Inclusions: (unless shown otherwise)

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a. Finish: US 26D.
b. Standards and Supports: KV 255 and 256.
c. Drawer Slides: KV 1300 (two per drawer).
d. Catches: Epco #590, provide two for doors over 3'-0" high.
e. Hinges: Stanley 1535 or 1590 where required, provide three for doors over 3'-0" high.
f. Pulls: Stanley 4484.
g. Locks: (where required) KV #985
h. Sliding Tracks (where indicated) Epco #234 and 2234

4. Casework for Transparent Finish: AWI Section 400, Premium grade.

5. Specialty hardware for Built-In Work Surfaces and Reception Desks: Doug Mockett & Co., as specified.
   a. Wire Managers: G-Shape, WM-4 Series, with accessories.
   b. Clean line Wire Managers: CL Series, with all accessories.
   c. Grommets: Innovator #INNV2, 4-9/16", Two Slot, color as selected by architect.

6. Plastics Bullnose Trim: PVC, Super High Gloss, furniture grade, full projection, as distributed by Outwater Plastics Industries.

2.3 PLASTIC LAMINATE WORK:

A. General: Where counters are indicated or required, provide complete with plastic laminated faces, edges, backsplashes and side splashes. Provide balancing (backing) sheets where required by AWI 400-26.

B. Material Surface Quality:

1. Horizontal Surfaces: Grade 10 (0.048" thick), general-purpose type, (high pressure).
2. Horizontal Surfaces: Grade 41 (0.051" thick), solid core type, high pressure.
3. Exposed Surfaces: Grade 20 (0.020" thick), general-purpose type (high-pressure).
4. Semi-Exposed parts: High-Pressure Laminate compatible color, nominal .028" thick.
5. Concealed parts: Grades 72 or 91, as required, (0.020" thick), backer type, (high-pressure).
6. Manufacture: Formica, grades as indicated; Wilson Art, or Nevamar; of the colors, textures, finish (reflectance) and patterns as selected.

C. Core: 3/4" thick particleboard, CS 236, Type 2, medium density, Class 1; Norbord "MR" Medium Density Fiberboard, Wheat Board; or other AWI approved core materials.

D. Quality for Integral Work: Where plastic laminate finished elements are an integral part of wood casework, provide same Quality Grade specified for other portions of casework.

E. Core for casework and countertops where sinks occur: Shop sanded exterior grade veneer core plywood; or industrial grade phenolic resin particleboard, fiberboard or wheat board with a 24 hr. thickness swell factor of 5% or less and a 24 hr. water absorption factor of 10% or less.

F. Openings: Cut openings in tops for equipment which is to be installed under other sections of these specifications. Verify size of opening with actual size of equipment to be used, prior to making openings. Form inside corners to a radius of not less than 1/8". After sawing, rout and file cutouts to ensure smooth, crack-free edges. Seal exposed edges after cutting with a waterproofing material recommended by the top material manufacturer.

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2.4 FIRE-RETARDANT-TREATED MATERIALS

A. General: Where fire-retardant-treated materials are indicated, use materials complying with requirements in this Article that are acceptable to authorities having jurisdiction and with fire-test-response characteristics specified.

1. Do not use treated materials that do not comply with requirements of referenced woodworking standard or that are warped, discolored, or otherwise defective.
2. Use fire-retardant-treatment formulations that do not bleed through or otherwise adversely affect finishes. Do not use colorants to distinguish treated materials from untreated materials.
3. Identify fire-retardant-treated materials with appropriate classification marking of UL, U.S. Testing, Timber Products Inspection, or another testing and inspecting agency acceptable to authorities having jurisdiction.

B. Fire-Retardant-Treated Lumber and Plywood by Pressure Process: Comply with performance requirements of AWPA C20 (lumber) and AWPA C27 (plywood). Use the following treatment type:

1. Exterior Type: Organic-resin-based formulation thermally set in wood by kiln drying.
2. Interior Type A: Low-hygroscopic formulation.
3. Mill lumber after treatment within limits set for wood removal that do not affect listed fire-test-response characteristics, using a woodworking plant certified by testing and inspecting agency.
4. Mill lumber before treatment and implement special procedures during treatment and drying processes that prevent lumber from warping and developing discolorations from drying sticks or other causes, marring, and other defects affecting appearance of treated woodwork.
5. Kiln-dry materials before and after treatment to levels required for untreated materials.

C. Fire-Retardant Particleboard: Panels complying with the following requirements, made from softwood particles and fire-retardant chemicals mixed together at time of panel manufacture to achieve flame-spread index of 25 or less and smoke-developed index of 25 or less per ASTM E 84.

1. For panels 3/4 inch thick and less, comply with ANSI A208.1 for Grade M-2 except for the following minimum properties: modulus of rupture, 1600 psi; modulus of elasticity, 300,000 psi; internal bond, 80 psi; and screw-holding capacity on face and edge, 250 and 225 lbf, respectively.
2. For panels 13/16 to 1-1/4 inches thick, comply with ANSI A208.1 for Grade M-1 except for the following minimum properties: modulus of rupture, 1300 psi; modulus of elasticity, 250,000 psi; linear expansion, 0.50 percent; and screw-holding capacity on face and edge, 250 and 175 lbf, respectively.
3. Product: Subject to compliance with requirements, provide "Duraflake FR" by Weyerhaeuser.

D. Fire-Retardant Fiberboard: Medium-density fiberboard panels complying with ANSI A208.2, made from softwood fibers, synthetic resins, and fire-retardant chemicals mixed together at time of panel manufacture to achieve flame-spread index of 25 or less and smoke-developed index of 200 or less per ASTM E 84.

1. Product: Subject to compliance with requirements, provide "Medite FR" by SierraPine Ltd.; Medite Div.

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2.5 FINISH FOR ARCHITECTURAL WOODWORK:

A. General: The entire finish of architectural woodwork is work of this section, regardless of whether shop applied or applied after installation.

B. Comply with AWI Quality Standards, Section 1500 Premium Grade, for sanding, filling countersunk fasteners, back priming and similar preparations for the finishing of architectural woodwork, as applicable to each unit of work. Sand Work smooth and set exposed nails and screws. Apply wood filler in exposed nail and screw indentations. Use wood filler that matches surrounding surfaces.

1. AWI Transparent Finish System: TR-4 Water White Conversion Varnish.
2. Sheen on 60° Gloss Meter (ASTM D 523): 40 Satin 30°-50°.
3. Effect: Open Pore.
4. Stain: Match Architects Sample.

C. Back prime and seal concealed or internal surfaces with two coats sealer compatible with thickness of exposed finish.

PART 3 - EXECUTION

3.1 PREPARATION:

A. Condition woodwork to average prevailing humidity conditions in installation areas prior to installing.

B. Do not deliver Work in this Section until all wet work is completed and that building is permanently enclosed and that the HVAC is operational.

C. Pre-Installation Meeting: Meet at the project site prior to delivery of architectural woodwork and review the coordination and environmental controls required for proper installation and ambient conditioning in the areas to receive the work. Include in the meeting the Contractor, and the related sub-contractors, the Architect and other Owner representatives (if any). Proceed with the woodwork installation only when everyone concerned agrees that the required ambient conditions can be properly maintained.

D. Deliver concrete inserts and similar anchoring devices to be built into substrates, well in advance of the time substrates are to be built.

E. Prior to installation of architectural woodwork, examine shop-fabricated work for completion and complete work as required, including back priming and removal of packing. Verify adequacy of backing and internal support framing.

3.2 INSTALLATION:

A. Comply with AWI Section 1700 Premium Grade.

B. Install the work plumb, level, true and straight with no distortions. Shim as required using concealed shims. Install to a tolerance of 1/8" in 8'-0" for plumb and level (including countertops); and with 1/16" maximum offset in flush adjoining surfaces, 1/8" maximum offsets in revealed adjoining surfaces.

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C. Scribe and cut work to fit adjoining work, and refinish cut surfaces or repair damaged finish at cuts.

D. Standing and Running Trim: Install with minimum number of joints possible, using full-length pieces (from maximum length of lumber available) to the greatest extent possible. Stagger joints in adjacent and related members. Cope at returns, miter at corners, and comply with Quality Standards for joinery.

E. Anchor woodwork to anchors or blocking built-in or directly attached to substrates. Secure to grounds, stripping and blocking with countersunk, concealed fasteners and blind nailing as required for a complete installation. Except where prefinished matching fasteners heads are required, use fine finishing nail for exposed nailings, countersunk and filled flush with woodwork, and matching finish where transparent finish is indicated.

F. Casework: Install without distortion so that doors and drawers will fit openings properly and be accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete the installation of hardware and accessory items as indicated. Maintain veneer sequence matching (if any) of casework with transparent finish.

G. Countertops: Anchor securely to base units and other support systems as indicated.

1. Where tops and/or splashes do not abut the adjacent wall surfaces, provide a clear paintable caulking bead or other approved trim closure.

H. Wood Shelving: Complete the assembly of units and install in the areas indicated, including hardware and accessories as indicated.

3.3 FASTENING OF INTERIOR WOODWORK:

A. Nailing: Blind nail where possible; where not possible, use fine finishing nails, countersunk, then fill voids with color-matched putty stick.

B. Anchoring: Secure woodwork to anchors or blocking built-in or directly attached to substrates.

3.4 ADJUSTMENT, CLEANING, FINISHING AND PROTECTION:

A. Repair damaged and defective woodwork wherever possible to eliminate defects functionally and visually; where not possible to repair properly, replace woodwork. Adjust joinery for uniform appearance.

B. Clean hardware, lubricate and make final adjustments for proper operation.

C. Clean woodwork on exposed and semi-exposed surfaces, including spaces within casework cabinets. Touch-up shop-applied finishes to restore damaged or soiled areas.

D. Complete the finishing work specified as work of this section, to whatever extent not completed at the shop or prior to installation of woodwork.

E. Protection: Advise the Contractor of final protection and conditions to be maintained to ensure that the work will be without damage or deterioration at the time of acceptance.

END OF SECTION 06 40 00

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SECTION 06 64 00 - PLASTIC PANELING, Hi-Impact

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 glass-fiber reinforced plastic (FRP) wall paneling and trim accessories.

B. Related Sections:

1. Division 06 Section "Rough Carpentry" for wood furring for installing plastic paneling.
2. Division 10 Section "Wall and Door Protection" for corner guards installed over plastic paneling.

1.3 ACTION SUBMITTALS

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

B. Samples for Initial Selection: For plastic paneling and trim accessories.

C. Samples for Verification: For plastic paneling and trim accessories, in manufacturer's standard sizes.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain plastic paneling and trim accessories from single manufacturer.

B. 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: 450 or less.
3. Testing Agency: Acceptable to authorities having jurisdiction FM Approvals or UL .

1.5 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install plastic paneling until spaces are enclosed and weathertight and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

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PART 2 - PRODUCTS

2.1 PLASTIC SHEET PANELING

A. General: Gelcoat-finished, glass-fiber reinforced plastic panels complying with ASTM D 5319.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Crane Composites or comparable product.

2. Low-Emitting Materials: Paneling 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."
3. Nominal Thickness: Not less than 0.09 inch (2.3 mm).
4. Surface Finish: Molded pebble texture or as selected by Architect from manufacturer's full range.
5. Color: White or as selected by Architect from manufacturer's full range.

2.2 ACCESSORIES

A. Trim Accessories: Manufacturer's standard one-piece vinyl extrusions designed to retain and cover edges of panels. Provide division bars, inside corners, outside corners, and caps as needed to conceal edges.

1. Color: Match panels.

B. Trim Accessories: Manufacturer's standard two-piece, snap-on vinyl extrusions designed to cover edges of panels. Provide division bars, inside corners, outside corners, and caps as needed to conceal edges.

1. Color: Match panels

C. Concealed Mounting Splines: Continuous, H-shaped aluminum extrusions designed to fit into grooves routed in edges of factory-laminated panels and to be fastened to substrate.

D. Adhesive: As recommended by plastic paneling manufacturer.

1. Adhesive shall have a VOC content of 50g/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."

E. Sealant: Single-component, mildew-resistant, neutral-curing silicone sealant recommended by plastic paneling manufacturer and complying with requirements in Division 07 Section "Joint Sealants."

1. Sealant shall have a VOC content of 250g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. 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."

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PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Remove wallpaper, vinyl wall covering, loose or soluble paint, and other materials that might interfere with adhesive bond.

B. Prepare substrate by sanding high spots and filling low spots as needed to provide flat, even surface for panel installation.

C. Clean substrates of substances that could impair bond of adhesive, including oil, grease, dirt, and dust.

D. Condition panels by unpacking and placing in installation space before installation according to manufacturer's written recommendations.

E. Lay out paneling before installing. Locate panel joints where indicated to provide equal panels at ends of walls so that trimmed panels at corners are not less than 12 inches (300 mm) wide.

1. Mark plumb lines on substrate at trim accessory and/or panel joint locations for accurate installation.
2. Locate trim accessories and/or panel joints to allow clearance at panel edges according to manufacturer's written instructions.

3.3 INSTALLATION

A. Install plastic paneling according to manufacturer's written instructions.

B. Install panels in a full spread of adhesive.

C. Install factory-laminated panels using concealed mounting splines in panel joints.

D. Fill grooves in trim accessories with sealant before installing panels and bed inside corner trim in a bead of sealant.

E. Maintain uniform space between panels and wall fixtures. Fill space with sealant.

F. Maintain uniform space between adjacent panels and between panels and floors, ceilings, and fixtures. Fill space with sealant.

G. Remove excess sealant and smears as paneling is installed. Clean with solvent recommended by sealant manufacturer and then wipe with clean dry cloths until no residue remains.

END OF SECTION 06 64 00

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SECTION 06 65 00 - SOLID SURFACING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Solid Surface Material.

B. Related Sections:

1. Architectural Woodwork: Section 064100.
2. Sealants: Section 079000.
3. Plumbing: Division 22.

1.3 SYSTEM DESCRIPTION

A. Solid Surface Sheet: Homogenous sheet material composed of acrylic resins, fire-retardant filler materials, and coloring agents.

1.4 SUBMITTALS

A. Comply with Division 1, unless otherwise indicated.

B. Product Data:

1. Detailed specification of construction and fabrication.
2. Manufacturer's installation instructions.
3. Manufacturer's detailed recommendations for handling, storage, installation, protection, and maintenance.

C. Shop Drawings: Installation details including location and layout of each type of fabrication and accessory.

D. Samples: Full range of colors and patterns.

E. Contract Closeout Submittals: Comply with Section 017000.

1.5 QUALITY ASSURANCE

A. Fabricator Qualifications: Certified solid surface fabricator/installer.

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B. Installer Qualifications: Firm experienced in installation or application of systems similar in complexity to those required for this Project, including specific requirements indicated.

1. Acceptable to or licensed by manufacturer.

C. Source Limitations: Obtain materials and products from single source.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver fabrications appropriately wrapped in protective materials.

B. Protect fabrications from damage.

1.7 PROJECT CONDITIONS

A. Maintain relative humidity planned for building occupants and an ambient temperature between 65F and 75F for 48 hours prior to and during installation. After installation, maintain relative humidity and ambient temperature planned for building occupants.

1.8 WARRANTY

A. Furnish manufacturer's limited 10 year warranty.

PART 2 - PRODUCTS

2.1 MANUFACTURER

A. Basis of Design: Wilsonart International, (800) 433-3222, www.wilsonart.com.

1. Gibraltar® Solid Surface, Type 051.

B. Substitutions: Substitutions permitted in accordance with Instructions to Bidders and Division 1 requirements.

2.2 MATERIAL

A. SOLID SURFACE SHEET

1. Nominal sheet thickness: 0.50 inch (13 mm)
2. Surface burning characteristics in accordance with ASTM E 84: Class I or A, and as follows:

   a. Flame spread: < 25.
   b. Smoke developed: <25.

3. Liquid Absorption, ISO 4586-2, for 1/2 inch material thickness: 0.4 percent after 2 hour period.
4. Izod Impact, ASTM D 256, Method A: 0.3 foot pounds per inch.
5. Tensile Modulus, ASTM D 638 Nominal: 1.2 million pounds per square inch.

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6. Thermal Expansion, ASTM D 696: 0.000018 inch per inch per degree F, maximum.
7. Hardness, ASTM D 2583, Barcol Impressor: 57.
8. Flexural Toughness, ASTM D 790: 3 (in.-lb,/in³).
9. Deflection Temperature under load, ASTM D 648: 90 degrees C.
10. Stain Resistance, ANSI Z-124.3 Modified; 3.4: No effect.
11. Boiling Water Resistance, NEMA LD 3-3.05: No effect.
12. High Temperature Resistance, NEMA LD 3-3.06: No effect.
13. Radiant Heat Resistance, NEMA LD 3-3.10: No effect.
14. Light Resistance, NEMA LD 3-3.03: No effect.
15. Ball Impact Resistance, NEMA LD 3-3.08, one half pound ball, unsupported: 125 inches.
16. Specific Gravity (Density ASTM D792): 1.60 grams per cubic centimeter.
17. Approximate weight: 4.20 pounds per square foot.
18. Weatherability, ASTM D 2565: Pass.
19. Fungus Resistance, ASTM G 21: Pass.
20. Bacterial Resistance, ASTM G 22: Pass.
21. Pittsburgh Protocol Toxicity: 66.9 grams.
22. Pattern and Finish: Milk Glass Spectra #9077-ST

2.3 ACCESSORY MATERIALS

A. Joint adhesive: Manufacturer’s standard adhesive to create inconspicuous, nonporous joints, with a chemical bond (WA8215).

1. Sealant: Standard mildew resistant, FDA/UL® recognized silicone sealant in color matched or clear formulations.
2. Sink/bowl mounting hardware: Manufacturer's approved bowl clips, brass inserts and fasteners for attachment of undermount sinks/bowls.

B. Sinks: Manufacturer’s Solid Surface Sink
1. Model: Oval ADA Vanity - Model BV1512
2. Color: As Selected by Architect.

2.4 FABRICATION

A. Fabrication to be performed by a certified solid surface fabricator/installer.

B. Fabricate components in shop to greatest extent practical to size and shape indicated, in accordance with approved shop drawing and published requirements.

C. Solid Surface Fabrication Manual

D. Form joints between components using manufacture’s standard joint adhesive. Joints shall be inconspicuous in appearance and without voids. Attach 4" (100mm) wide Gibraltar® reinforcing strip under joints required by Deck Seam Section of the Solid Surface Fabrication Manual.

E. Provide holes and cutouts for plumbing and bath accessories as indicated on shop drawings.

F. Rout and finish component edges to a smooth, uniform finish. Rout all cutouts then sand all edges smooth. Repair or reject defective or inaccurate work.

G. Finish: Surfaces shall have a uniform finish.

1. Matte: Standard finish for least amount of maintenance.

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PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates to receive solid surfacing. Identify conditions detrimental to proper or timely installation. Do not commence installation until conditions have been corrected.

3.2 PREPARATION

A. Precondition Wilsonart® Solid Surfacing in accordance with manufacturer's printed installation instructions.

3.3 INSTALLATION

A. Install components plumb and level, in accordance with approved shop drawings, project installation details and manufacturer's printed instructions.

B. Form joints using manufacturer's approved adhesive, with joints inconspicuous in finished work.

C. Adhere undermount sinks/bowls to countertop using manufacturer's recommended joint adhesive.

D. Provide backsplashes and endsplashes as indicated on the drawings. Adhere to countertops using manufacturer's recommended silicone sealant.

E. Remove excessive adhesive and sealants. Components shall be clean on Date of Substantial Completion.

F. Coordinate plumbing installation with Division 22.

3.4 PROTECTION

A. Protect surfaces from damage until Date of Substantial Completion. Repair or replace damaged components that cannot be repaired to architect's satisfaction.

B. Fabricator/Installer to provide the Wilsonart® Care and Maintenance kit, review maintenance procedures and the Wilsonart® warranty with the head of maintenance upon completion of project.

END OF SECTION 06 65 00

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SECTION 07 21 50 - SOUND ATTENUATION BATTS

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: Glass fiber acoustical insulation for interior wall partitions as indicated.

1.3 MATERIALS PROVIDED IN OTHER SECTIONS

A. Division 07 Section “Insulation”.

B. Division 09 Section “Gypsum Drywall”.

C. Division 09 Section “Gypsum Board Shaft Wall Assemblies”.

D. Division 09 Section “Non-Structural Metal Framing”.

1.4 REFERENCES

A. American Society for Testing and Materials (ASTM).

1. C 665 Specification for Mineral Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.
2. E 84 Test Method for Surface Burning Characteristics of Building Materials.
3. E 119 Test Method for Fire Tests of Building Construction Materials.
4. E 136 Test Method for Behavior of Materials in a Vertical Tube Furnace at 750°C.

1.5 SUBMITTALS

A. Product Data: Submit product literature, samples, and installation instructions for approved insulation.

1.6 DELIVERY, STORAGE AND HANDLING

A. Protect insulation from physical damage and from becoming wet, soiled, or covered with ice or snow. Comply with manufacturer’s recommendations for handling, storage and protection during installation.

B. Label insulation packages to include material name, production date and/or product code.

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PART 2 - PRODUCTS

2.1 MANUFACTURER

A. Owens Corning, as specified; equivalent products by Certainteed or Johns Manville may be submitted for approval.

2.2 MATERIAL

A. Type: OC “Sound Attenuation Batts”, unfaced glass fiber acoustical insulation complying with ASTM C 665, Type I.

1. Size:

a. Thickness: as detailed, to provide indicated STC
b. Width: To suit stud spacing

2. Surface Burning Characteristics: When tested in accordance with ASTM E 84.

a. Maximum flame spread: 10
b. Maximum smoke developed: 10

3. Combustion Characteristics: Noncombustible, tested in accordance with ASTM E 136.
4. Fire Resistance Ratings: Wall assemblies containing Owens Corning SAB have achieved fire resistance ratings when tested in accordance with ASTM E119. See listing documents for full assembly construction details.
5. Sound Transmission Class: STC required, as indicated in details.
6. Dimensional Stability: Linear shrinkage less than 0.1 %

B. Concealed Blanket Type Insulation:

1. Poly-encapsulated, formaldehyde-free fiberglass insulation above indicated ceilings.

2.3 BLANKET INSULATION:

A. Provide above ceiling insulation, as shown, equal to “Johns Manville ComfortTherm Formaldehyde-free Thermal and Acoustical Fiber Glass Insulation.” Thermal resistance “R” (RSI) values of the insulation shall be R (RSI) 19 in ceilings.

B. Criteria:

1. ASTM C 665, Type II, Class A, Category 1
2. ASTM E 96 Permeability; vapor retarder facer films on standard product: 0.5 Perms.
3. UL File R3711
4. ASTM E 84 Flame Spread 25 or less, Smoke Developed 50 or less

PART 3 - EXECUTION

3.1 INSPECTION AND PREPARATION

A. Examine substrates and conditions under which insulation work is to be performed. A satisfactory substrate is one that complies with requirements of the section in which substrate and related work is specified.

B. Obtain installer's written report listing conditions detrimental to performance of work in this section. Do not proceed with installation of insulation until unsatisfactory conditions have been corrected.

C. Clean substrates of substances harmful to insulation.

3.2 INSTALLATION-GENERAL

A. Comply with manufacturer's instructions for particular conditions of installation in each case.

B. Sound Attenuation Batts may be friction-fit in place until the interior finish is applied. Install batts to fill entire stud cavity. If stud cavity is less than 96" in height, cut lengths to friction fit against floor and ceiling tracks. Walls with penetrations require that insulation be carefully cut to fit around outlets, junction boxes and other irregularities.

C. Where walls are not finished on both sides or insulation does not fill the cavity depth, provide manufacturer approved supplementary support to hold insulation in place.

D. Where insulation must extend higher than 8 feet, temporary support can be provided to hold product in place until the finish material is applied.

E. Extend fiberglass insulation full thickness as shown over entire surface. Cut and fit tightly around obstructions, and fill voids with insulation. Install a single layer, unless otherwise shown, with joints staggered in one direction.

1. Provide two layers for applications in excess of 6".

3.3 PROTECTION

A. Protect installed insulation as recommended by approved manufacturer.

END OF SECTION 07 21 00

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SECTION 07 92 00 - JOINT SEALANTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes: The extent of each type of joint sealer is indicated. Provide "sealant" for all exterior joints, certain indicated interior joints, and where "mastic" is indicated. Provide "calking" at all remaining interior joints.

B. The required applications include, but are not limited to the following:
   1. Exterior building wall joints.
   2. Flashing and coping joints.
   3. Joints at openings and indicated frames or subframes.

1.3 PRE-INSTALLATION MEETING:

A. Pre-Installation Meeting: Meet at the project well in advance of the time scheduled for work, (a minimum of one week), and review requirements for the work and conditions which could possibly interfere with successful performance of the work. Require all parties concerned with the work, or required to coordinate with it, or to protect it thereafter, to attend the meeting, including:

   1. Owner or Representative
   2. General Contractor
   3. Installer
   4. Manufacturer(s) Representatives
   5. Architect

1.4 QUALITY ASSURANCE:

A. At the Owner's option, testing of depth of joint material may be undertaken to insure compliance with the specification and conformance to manufacturer's specifications and recommendations for joint design. If the joint fails to comply with design requirements, the Contractor shall pay for the cost of testing and replacement of all affected joints.

1.5 SUBMITTALS:

A. Product Data:

   1. For information only, submit copies of manufacturer's specifications, recommendations and installation instructions for each type of material required. Include manufacturer's published

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data, or letter of certification, or certified test laboratory report indicating that each material complies with the requirements and is intended generally for the applications shown.

B. Samples:

1. Submit samples of each color required (except black) for each type of joint sealer exposed to view. Install sample between two strips of material similar to or representative of typical surfaces where sealer will be used, held apart to represent typical joint widths. Samples will be reviewed for color and texture only. Compliance with all other requirements is the exclusive responsibility of the Contractor.

C. Guarantee:

1. Submit copies of written two-year guarantee agreeing to repair or replace joint sealers which fail to perform as air-tight and water-tight joints; or fail in joint adhesion, cohesion, abrasion resistance, weather resistance, extrusion resistance, migration resistance, stain resistance, or general durability; or appear to deteriorate in any other manner not clearly specified by submitted manufacturer's data as an inherent quality of the material for the exposure indicated.

a. Provide guarantee signed by the Installer and Contractor.

1.6 JOB CONDITIONS:

A. Examine the joint surfaces and backing, and their anchorage to the structure, and the conditions under which the joint sealer work is to be performed. Do not proceed with the joint sealer work until unsatisfactory conditions have been corrected.

B. Weather Conditions: Do not proceed with installation of sealants under adverse weather conditions, or when temperatures are below or above manufacturer's recommended limitations for installation. Proceed with the work only when weather conditions are favorable for proper cure and development of high early bond strength. Where joint width is affected by ambient temperature variations, install elastomeric sealants when temperatures are in the lower third of manufacturer's recommended installation temperature range.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL:

A. Colors: For exposed materials provide color as indicated or, if not indicated, as selected from manufacturer's standard colors. For concealed materials, provide the natural color which has the best overall performance characteristics.

B. Hardness: As recommended by manufacturer for application shown.

C. Modulus of Elasticity: Provide the lowest available modulus of elasticity which is consistent with exposure to weathering, indentation, vandalism, abrasion, support of loading, and other requirements.

D. Compatibility: Before purchase of each required material, confirm its compatibility with each material it will be exposed to in the joint system.

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E. Size and Shape: As shown or, if not shown, as recommended by the manufacturer for the type and condition of joint, and for the indicated joint performance or movement.

F. Grade of Sealant: For each application, provide the grade of sealant (non-sag, self-leveling, no-track, knife grade, preformed, etc.) recommended by the manufacturer for the particular condition of installation (location, joint shape, ambient temperature, and similar conditions), to achieve the best possible overall performance. Grades specified herein are for normal condition of installation.

2.2 SEALANTS (See Sealant Schedule at end of Section for specific use of sealants.)

A. Urethanes:

1. Type “A1”: Two-Part Urethane: Self-Leveling, ASTM C920, Type M, Grade P, Class 25. (Fed. Spec. TT-S-00227E Type I, Class A.)

   a. Chem-Calk CC-550, by Bostik.
   b. Vulkem 245, by Tremco.
   c. Vulkem 255, Wide-Joint, by Tremco.
   d. NR-200 Urexpan, by Pecora Corporation.
   e. Sikaflex-2c NS/SL, by Sika Corporation.
   f. SL-2, by Sonneborn

2. Type “A2”: Two-Part Urethane: Non-Sag, ASTM C920, Type M, Grade NS, Class 25. (Fed. Spec. TT-S-00227E Type II, Class A.)

   a. Chem-Calk 500, by Bostik.
   b. Vulkem 227, by Tremco.
   c. Dynatrol II, by Pecora Corporation.
   d. Sikaflex-2c NS/SL, by Sika Corporation.
   e. Sonolastic NP 2, by Sonneborn Building Products, ChemRex Inc.
   f. Dymeric, by Tremco

3. Type “A3”: One-Part Urethane: Self-Leveling, ASTM C920, Type S, Grade P, Class 25. (Fed. Spec. TT-S-00230C Type I, Class A.)

   a. Vulkem 45, by Tremco.
   b. Urexpan NR-201, by Pecora Corporation.
   c. Sonolastic SL1, by Sonneborn Building Products, ChemRex Inc.

4. Type “A4”: One-Part Urethane: Non-Sag, ASTM C920, Type S, Grade NS, Class 25. (Fed. Spec. TT-S-00230C Type II, Class A.)

   a. Chem-Calk 900, by Bostik.
   b. Vulkem 116, by Tremco.
   c. Sonolastic NP I, by Sonneborn Building Products, ChemRex Inc.
   d. Dymonic, by Tremco.

B. Silicones:

1. Type “B1”: One-Part Silicones: ASTM C920, Type S, Grade NS, Class 25. Vertical Surfaces Only.

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a. 795 Silicone Structural Glazing, Glazing, and Weatherproofing Sealant, by Dow Corning.
b. 864 Architectural Silicone, by Pecora Corporation.
c. Sonolastic 150 Silyl Terminated polyether, by Sonneborn
d. Spectrem 3, by Tremco.

2. Type “B2”: One-Part Silicones: ASTM C920, Type S, Grade NS, Class 25. Vertical Surfaces Only.

a. 795 Silicone Structural Glazing, Glazing, and Weatherproofing Sealant, by Dow Corning. (colors only)
b. 999-A, Dow Corning.
c. Construction 1200 Sealant, General Electric Company.
d. Sonolastic 150 Silyl Terminated polyether, by Sonneborn (Not for wet glazing)
e. Spectrem 2, by Tremco.

3. Type “B3”: One-Part Silicones: ASTM C920, Type S, Grade NS, Class 25. Vertical Surfaces Only.

a. 795 Silicone Structural Glazing, Glazing, and Weatherproofing Sealant, by Dow Corning. (colors only)
b. Construction 1200 Sealant, General Electric Company.
c. 999-A, Dow Corning.
d. 864 Architectural Silicone, by Pecora Corporation. (colors only)
e. Sonolastic 150 Silyl Terminated polyether, by Sonneborn
f. Spectrem 1, by Tremco.

C. Acrylics, Latex: (For interior use only.)

1. Type “C1”: One-Part Acrylic Latex, Non-Sag, ASTM-C-834-76.

a. Chem-Calk 600, by Bostik.
b. LC-130, by MACCO Adhesives, The Glidden Company.
c. Easa-ply ALS, by W. R. Meadows, Inc.
d. AC-20+Silicone Acrylic Latex, by Pecora Corporation.
e. Sonolac, Sonneborn Building Products, ChemRex Inc.

D. Acoustical Sealants:

1. Type “D1”:

a. AC-20 FTR Acoustical and Insulation Sealant, by Pecora Corporation.
b. 60+ Unicrylic, by Pecora Corporation.
c. Sheetrock Acoustical Sealant, by United States Gypsum.

E. Butyls:

1. Type “E1”: One-Part Butyl, Non-Sag, FS TT-S-1657.

a. Chem-Calk 300, by Bostik.
b. BC-158 Butyl Rubber, by Pecora Corporation. (ASTM C1085)

F. Preformed Compressible & Non-Compressible Fillers:

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1. Type “F1”: Backer Rod - Closed cell polyethylene foam:

   a. HBR Backer Rod, by Nomaco.
   b. #92 Greenrod, by Nomaco.
   c. Sonolastic Closed-Cell Backer Rod, Sonneborn Building Products, ChemRex Inc.
   d. Soft Cell Backer Rod (Non-gassing), by Sonneborn.

2.3 MISCELLANEOUS ACCESSORIES:

A. Joint Primer/Sealer: Provide the type of joint primer/sealer recommended by the sealant manufacturer for the joint surfaces to be primed or sealed.

B. Bond Breaker Tape: Polyethylene tape or other plastic tape recommended by the sealant manufacturer to be applied to sealant-contact surfaces where bond to the substrate or joint filler must be avoided for proper performance of sealant. Provide self-adhesive tape where applicable.

C. Sealant Backer Rod: Compressible rod stock of polyethylene foam, polyethylene jacketed polyurethane foam, butyl rubber foam, neoprene foam; or other flexible, permanent, durable non-absorptive material as recommended by the sealant manufacturer.

PART 3 - EXECUTION

3.1 Manufacturer's Instructions:

1. Comply with manufacturer's printed instructions except where more stringent requirements are shown or specified, and except where manufacturer's technical representative directs otherwise.

B. Joint Preparation:

1. Clean joint surfaces immediately before installation of sealant or calking compound. Remove dirt, insecure coatings, moisture and other substances which would interfere with bond of sealant or calking compound. Etch concrete and masonry joint surfaces and roughen vitreous or glazed joint surfaces as recommended by sealant manufacturer.
2. Prime or seal the joint surfaces where recommended by the sealant manufacturer. Do not allow primer/sealer to spill or migrate onto adjoining surfaces.

3.2 INSTALLATION:

A. Set joint filler units at proper depth or position in the joint to coordinate with other work, including the installation of bond breakers, backer rods and sealants. Do not leave voids or gaps between the ends of joint filler units.

B. Install sealant backer rod for liquid elastomeric sealants, except where shown to be omitted or recommended to be omitted by sealant manufacturer for the application shown.

C. Install bond breaker tape where required by manufacturer's recommendations to ensure that elastomeric sealants will perform properly.

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D. Employ only proven installation techniques, which will ensure that sealants will be deposited in uniform, continuous ribbons without gaps or air pockets, with complete "wetting" of the joint bond surfaces equally on opposite sides. Fill sealant rabbet to a slightly concave surface, between a horizontal surface and vertical surface, fill joint to form a slight cove, so that joint will not trap moisture and dirt.

E. Install sealants to depths recommended by the sealant manufacturer but within the following general limitations, measured at the center (thin) section of the bead:

1. For sidewalks, pavements and similar joints sealed with elastomeric sealants and subject to traffic and other abrasion and indentation exposures, fill joints to a depth equal to 75% of joint width, but neither more than 5/8" deep nor less than 3/8" deep.
2. For normal moving joints sealed with elastomeric sealants but not subject to traffic, fill joints to a depth equal to 50% of joint width, but neither more than 1/2" deep nor less than 1/4" deep.
3. For joints sealed with non-elastomeric sealants and calking compounds, fill joints to a depth in the range of 75% to 125% of joint width.
4. Spillage: Do not allow sealants or compounds to overflow or spill onto adjoining surfaces, or to migrate into the voids of adjoining surfaces. Clean the adjoining surfaces by whatever means may be necessary to eliminate evidence of spillage.
5. Do not overheat hot-applied sealants.
6. Recess exposed edges of joint fillers slightly behind adjoining surfaces, so compressed units will not protrude from the joint.

3.3 CURE AND PROTECTION:

A. Cure sealants and calking compounds in compliance with manufacturer's instructions and recommendations, to obtain high early bond strength, internal cohesive strength and surface durability. Advise the Contractor of procedures required for the cure and protection of joint sealers during the construction period, so that they will be without deterioration or damage (other than normal wear and weathering) at the time of acceptance.

3.4 SEALANT SCHEDULE

A. Exterior Joints:

1. Perimeters of exterior openings where frames and other penetrations meet exterior facade of building: precast concrete, brick, CMU, reinforced concrete.

   a. Sealant Type - A2
   b. Sealant Type - B1 (for prefinished materials only)

2. Coping joints, coping-to-facade joints, cornice and wash, or horizontal surface joints not subject to foot or vehicular traffic.

   a. Sealant Type - A2
   b. Sealant Type - A4
   c. Sealant Type - B1 (for prefinished materials only)

3. Exterior joints in horizontal wearing and non-wearing surfaces.

   a. Sealant Type - A1

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b. Sealant Type - A3
c. Backer Material Type - F1

4. Setting bed for threshold and saddles.

a. Sealant Type - E1

5. Painted metal lap or flashing joints.

a. Sealant Type - B1

B. Interior Joints:

1. Seal interior perimeters of exterior openings.

a. For all of the above interior joints:

1) Sealant Type - A2
2) Sealant Type - A4
3) Sealant Type - B1 (for prefinished materials only)

2. Exposed interior control joints in drywall and concealed joints.

a. Sealant Type - C1
b. Sealant Type - D1

3. Painted metal lap joints.

a. Sealant Type - B1

C. Glazing:

1. Structural Glazing.

a. Sealant Type - B2
b. Sealant Type - B3

2. General Purpose Glazing.

a. Sealant Type - B3

3. End Damming.

a. Sealant Type - E1

END OF SECTION 07 90 00

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SECTION 08 11 10 - HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Standard and custom hollow metal doors and frames.
2. Steel sidelight, borrowed lite and transom frames.
3. Light frames and glazing installed in hollow metal doors.

B. Related Sections:

1. Division 04 Section "Unit Masonry" for embedding anchors for hollow metal work into masonry construction.
2. Division 07 Section ‘Insulated Metal Wall Panels”
3. Division 08 Section “Flush Wood Doors”.
4. Division 08 Section "Glazing" for glass view panels in hollow metal doors.
5. Division 08 Section "Door Hardware".
6. Division 08 Section "Access Control Hardware".
7. Division 09 Sections "Exterior Painting" and "Interior Painting" for field painting hollow metal doors and frames.
8. Division 13 Section “Metal Building System”

C. Codes and References: Comply with the version year adopted by the Authority Having Jurisdiction.

1. ANSI/SDI A250.8 - Recommended Specifications for Standard Steel Doors and Frames.
2. ANSI/SDI A250.4 - Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames, Frames Anchors and Hardware Reinforcing.
3. ANSI/SDI A250.6 - Recommended Practice for Hardware Reinforcing on Standard Steel Doors and Frames.
4. ANSI/SDI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames.
5. ANSI/SDI A250.11 - Recommended Erection Instructions for Steel Frames.
6. ASTM A1008 - Standard Specification for Steel Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.
7. ASTM A653 - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
8. ASTM A924 - Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.
9. ASTM C 1363 - Standard Test Method for Thermal Performance of Building Assemblies by Means of a Hot Box Apparatus.
10. ANSI/BHMA A156.115 - Hardware Preparation in Steel Doors and Frames.
11. ANSI/SDI 122 - Installation and Troubleshooting Guide for Standard Steel Doors and Frames.

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12. ANSI/NFPA 80 - Standard for Fire Doors and Fire Windows; National Fire Protection Association.
13. ANSI/NFPA 105: Standard for the Installation of Smoke Door Assemblies.
14. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies; National Fire Protection Association.
15. UL 10C - Positive Pressure Fire Tests of Door Assemblies.
16. UL 1784 - Standard for Air Leakage Tests of Door Assemblies.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, core descriptions, hardware reinforcements, profiles, anchors, fire-resistance rating, and finishes.

B. Door hardware supplier is to furnish templates, template reference number and/or physical hardware to the steel door and frame supplier in order to prepare the doors and frames to receive the finish hardware items.

C. Shop Drawings: Include the following:

1. Elevations of each door design.
2. Details of doors, including vertical and horizontal edge details and metal thicknesses.
3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
4. Locations of reinforcement and preparations for hardware.
5. Details of anchorages, joints, field splices, and connections.
6. Details of accessories.
7. Details of moldings, removable stops, and glazing.
8. Details of conduit and preparations for power, signal, and control systems.

D. Samples for Verification:

1. Samples are only required by request of the architect and for manufacturers that are not current members of the Steel Door Institute.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain hollow metal doors and frames through one source from a single manufacturer wherever possible.

B. Quality Standard: In addition to requirements specified, comply with ANSI/SDI A250.8, latest edition, "Recommended Specifications for Standard Steel Doors and Frames".

C. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252 (neutral pressure at 40” above sill) or UL 10C.

1. Oversize Fire-Rated Door Assemblies Construction: For units exceeding sizes of tested assemblies, attach construction label certifying doors are built to standard construction requirements for tested and labeled fire rated door assemblies except for size.
2. Temperature-Rise Limit: Where indicated and at vertical exit enclosures (stairwell openings) and exit passageways, provide doors that have a maximum transmitted temperature end point of not more than 450 deg F (250 deg C) above ambient after 30 minutes of standard fire-test exposure.
3. Smoke Control Door Assemblies: Comply with NFPA 105.

a. Smoke "S" Label: Doors to bear “S” label, and include smoke and draft control gasketing applied to frame and on meeting stiles of pair doors.

D. Fire-Rated, Borrowed-Light Frame Assemblies: Assemblies complying with NFPA 80 that are listed and labeled, by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing according to NFPA 257. Provide labeled glazing material.

E. Pre-Submittal Conference: Conduct conference in compliance with requirements in Division 01 Section "Project Meetings" with attendance by representatives of Supplier, Installer, and Contractor to review proper methods and procedures for installing hollow metal doors and frames and to verify installation of electrical knockout boxes and conduit at frames with electrified or access control hardware.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver hollow metal work palletized, wrapped, or crated to provide protection during transit and Project site storage. Do not use non-vented plastic.

B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.

C. Store hollow metal work under cover at Project site. Place in stacks of five units maximum in a vertical position with heads up, spaced by blocking, on minimum 4-inch high wood blocking. Do not store in a manner that traps excess humidity.

1. Provide minimum 1/4-inch space between each stacked door to permit air circulation. Door and frames to be stacked in a vertical upright position.

1.6 PROJECT CONDITIONS

A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

1.7 COORDINATION

A. Coordinate installation of anchorages for hollow metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.

1.8 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace doors that fail in materials or workmanship within specified warranty period.

B. Warranty includes installation and finishing that may be required due to repair or replacement of defective doors.

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PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

1. CECO Door Products.
2. Curries Company.
3. Steelcraft.

2.2 MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.

B. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B; with minimum G60 (Z180) or A60 (ZF180) metallic coating.

C. Frame Anchors: ASTM A 653/A 653M, Commercial Steel (CS), Commercial Steel (CS), Type B; with minimum G60 (Z180) or A60 (ZF180) metallic coating.

2.3 STANDARD HOLLOW METAL DOORS

A. General: Provide 1-3/4 inch doors of design indicated, not less than thickness indicated; fabricated with smooth surfaces, without visible joints or seams on exposed faces unless otherwise indicated. Comply with ANSI/SDI A250.8.

B. Interior Doors: Face sheets fabricated of commercial quality cold rolled steel that complies with ASTM A 1008/A 1008M. Provide doors complying with requirements indicated below by referencing ANSI/SDI A250.8 for level and model and ANSI/SDI A250.4 for physical performance level:

1. Design: Flush panel.
2. Core Construction: Manufacturer's standard kraft-paper honeycomb, or one-piece polystyrene core, securely bonded to both faces.

   a. Fire Door Core: As required to provide fire-protection and temperature-rise ratings indicated.

3. Top and Bottom Edges: Reinforce tops and bottoms of doors with a continuous steel channel not less than 16 gauge, extending the full width of the door and welded to the face sheet.
4. Hinge Reinforcement: Minimum 7 gauge (3/16") plate 1-1/4" x 9" or minimum 14 gauge continuous channel with pierced holes, drilled and tapped.
5. Hardware Reinforcements: Fabricate according to ANSI/SDI A250.6 with reinforcing plates from same material as door face sheets.

C. Manufacturers Basis of Design:

1. CECO Door Products Legion Series.
2. Curries Company 707 Series.

2.4 ENERGY-EFFICIENT HOLLOW METAL DOORS

A. General: Provide 1-3/4 inch doors of design specified, not less than thickness indicated; fabricated with smooth surfaces, without visible joints or seams on exposed faces unless otherwise indicated. Comply with ANSI/SDI A250.8 and ANSI/NAAMM HMMA 867.

B. Energy Efficient Exterior Doors: Face sheets fabricated of commercial quality hot-dipped zinc coated steel that complies with ASTM A924 A60. Provide doors complying with requirements indicated below by referencing ANSI/SDI A250.8 for level and model, ANSI/SDI A250.4 for physical performance level, and HMMA 867 for door construction.

1. Design: Flush panel.
2. Core Construction: Foamed in place polyurethane and steel stiffened laminated core with no stiffener face welds, in compliance with HMMA 867 “Laminated Core”.

   a. Provide 22 gauge steel stiffeners at 6 inches on-center internally welded at 5" on-center to integral core assembly, foamed in place polyurethane core chemically bonded to all interior surfaces. No stiffener face welding is permitted.
   b. Thermal properties to rate at a fully operable minimum U-Factor 0.29 and R-Value 3.4, including insulated door, thermal-break frame and threshold.

      1) Kerf Type Frames: Thermal properties to rate at a fully operable minimum U-Factor 0.36 and R-Value 2.7, including insulated door, kerf type frame, and threshold.

3. Level/Model: Level 2 and Physical Performance Level A (Heavy Duty), Minimum 18 gauge (0.042 inch - 1.1-mm) thick steel, Model 2.
4. Vertical Edges: Vertical edges to be mechanically interlocked with hairline seam. Beveled Lock Edge, 1/8 inch in 2 inches (3 mm in 50 mm).
5. Top and Bottom Edges: Reinforce tops and bottoms of doors with a continuous steel channel not less than 16 gauge, extending the full width of the door and welded to the face sheet. Doors with an inverted top channel to include a steel closure channel, screw attached, with the web of the channel flush with the face sheets of the door. Plastic or composite channel fillers are not acceptable.
6. Hinge Reinforcement: Minimum 7 gauge (3/16") plate 1-1/4" x 9".
7. Hardware Reinforcements: Fabricate according to ANSI/SDI A250.6 with reinforcing plates from same material as door face sheets.

C. Manufacturers Basis of Design:

1. CECO Door Products Trio-E/Trio Series.
2. Curries Company 777 Trio-E/Trio Series.

2.5 STANDARD HOLLOW METAL FRAMES

A. General: Comply with ANSI/SDI A250.8 and with details indicated for type and profile.

B. Interior Frames: Fabricated from cold-rolled steel sheet that complies with ASTM A 1008/A 1008M.

1. Fabricate frames with mitered or coped corners.
2. Fabricate frames, with the exception of slip-on drywall types, with "closed and tight" miter seams continuously welded on face, finished smooth with no visible seam unless otherwise indicated.

3. Frames for Steel Doors: Minimum 16 gauge (0.053-inch -1.3-mm) thick steel sheet.
4. Frames for openings up to 48 inches in width: Minimum 16 gauge (0.053-inch -1.3-mm) thick steel sheet.]
5. Frames for openings 48 inches and wider in width: Minimum 14 gauge (0.067-inch -1.7-mm) thick steel sheet.]
6. Frames for Wood Doors: Minimum 16 gauge (0.053-inch-1.3-mm-) thick steel sheet.
7. Frames for Borrowed Lights: Minimum 16 gauge (0.053-inch-1.3-mm-) thick steel sheet.
8. Manufacturers Basis of Design:

    a. CECO Door Products BQ/BU/DQ/DU/BR/DR Series (Drywall Profile).
    b. CECO Door Products SQ/SU/SR Series (Masonry Profile).
    c. Curries Company C/CM/CG Series (Drywall Profile).
    d. Curries Company M/G Series (Masonry Profile).

C. Fire rated frames: Fabricate frames in accordance with NFPA 80, listed and labeled by a qualified testing agency, for fire-protection ratings indicated.

D. Hardware Reinforcement: Fabricate according to ANSI/SDI A250.6 Table 4 with reinforcement plates from same material as frames.

2.6 ENERGY-EFFICIENT HOLLOW METAL FRAMES

A. Weatherstripped Frames: Subject to the same compliance standards and requirements as standard hollow metal frames, provide where indicated weatherstripped profiles with 1/8" integral kerf formed into the frame soffit able to receive manufacturer's listed gasket material. Available for use in both masonry and drywall construction, with fire rating up to 3 hours complying with NFPA 105, UL 1784, and ASTM E-283 Test criteria.

1. Manufacturers Basis of Design:

    a. CECO Door Products - Weatherstripped SQW/SRW Series.
    b. Curries Company - Weatherstripped WC/WM Series.

2.7 FRAME ANCHORS

A. Jamb Anchors:

1. Masonry Type: Adjustable strap-and-stirrup or T-shaped anchors to suit frame size, formed from A60 metallic coated material, not less than 0.042 inch thick, with corrugated or perforated straps not less than 2 inches wide by 10 inches long; or wire anchors not less than 0.177 inch thick.
2. Stud Wall Type: Designed to engage stud and not less than 0.042 inch thick.
3. Compression Type for Drywall Slip-on (Knock-Down) Frames: Adjustable compression anchors.
4. Windstorm Opening Anchors: Types as tested and required for indicated wall types to meet specified wind load design criteria.
5. FEMA 361 Storm Shelter Anchors: Masonry T-shaped, wire masonry type, or existing opening type anchors.

B. Floor Anchors: Floor anchors to be provided at each jamb, formed from A60 metallic coated material, not less than 0.042 inches thick.

C. Mortar Guards: Formed from same material as frames, not less than 0.016 inches thick.

2.8 HOLLOW METAL PANELS

A. Provide hollow metal panels of same materials, construction, and finish as specified for adjoining hollow metal work.

2.9 LIGHT OPENINGS AND GLAZING

A. Stops and Moldings: Provide stops and moldings around glazed lites where indicated. Form corners of stops and moldings with butted or mitered hairline joints at fabricator's shop. Fixed and removable stops to allow multiple glazed lites each to be removed independently. Coordinate frame rabbet widths between fixed and removable stops with the type of glazing and installation indicated.

B. Moldings for Glazed Lites in Doors and Loose Stops for Glazed Lites in Frames: Minimum 20 gauge thick, fabricated from same material as door face sheet in which they are installed.

C. Fixed Frame Moldings: Formed integral with hollow metal frames, a minimum of 5/8 inch (16 mm) high unless otherwise indicated. Provide fixed frame moldings and stops on outside of exterior and on secure side of interior doors and frames

D. Preformed Metal Frames for Light Openings: Manufacturer's standard frame formed of 0.048-inch-thick, cold rolled steel sheet; with baked enamel or powder coated finish; and approved for use in doors of fire protection rating indicated. Match pre-finished door paint color where applicable.

E. Glazing: Comply with requirements in Division 08 Section "Glazing" and with the hollow metal door manufacturer's written instructions.

1. Factory Glazing: Factory install glazing in doors as indicated. Doors with factory installed glass to include all of the required glazing material.

2.10 ACCESSORIES

A. Mullions and Transom Bars: Join to adjacent members by welding or rigid mechanical anchors.

B. Grout Guards: Formed from same material as frames, not less than 0.016 inches thick.

2.11 FABRICATION

A. Fabricate hollow metal work to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for thickness of metal. Where practical, fit and assemble units in manufacturer's plant. When shipping limitations so dictate, frames for large openings are to be fabricated in sections for splicing or splining in the field by others.

B. Tolerances: Fabricate hollow metal work to tolerances indicated in ANSI/SDI A250.8.

C. Hollow Metal Doors:

1. Exterior Doors: Provide optional weep-hole openings in bottom of exterior doors to permit moisture to escape where specified.
2. Glazed Lites: Factory cut openings in doors with applied trim or kits to fit. Factory install glazing where indicated.

3. Astragals: Provide overlapping astragals as noted in door hardware sets in Division 08 Section "Door Hardware" on one leaf of pairs of doors where required by NFPA 80 for fire-performance rating or where indicated. Extend minimum 3/4 inch beyond edge of door on which astragal is mounted.
4. Continuous Hinge Reinforcement: Provide welded continuous 12 gauge strap for continuous hinges specified in hardware sets in Division 08 Section "Door Hardware".

D. Hollow Metal Frames:

1. Shipping Limitations: Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.
2. Welded Frames: Weld flush face joints continuously; grind, fill, dress, and make smooth, flush, and invisible.

    a. Welded frames are to be provided with two steel spreaders temporarily attached to the bottom of both jambs to serve as a brace during shipping and handling. Spreader bars are for bracing only and are not to be used to size the frame opening.

3. Sidelight and Transom Bar Frames: Provide closed tubular members with no visible face seams or joints, fabricated from same material as door frame. Fasten members at crossings and to jambs by butt welding.
4. High Frequency Hinge Reinforcement: Provide high frequency hinge reinforcements at door openings 48-inches and wider with mortise butt type hinges at top hinge locations.
5. Continuous Hinge Reinforcement: Provide welded continuous 12 gauge straps for continuous hinges specified in hardware sets in Division 08 Section "Door Hardware".
6. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated for removable stops, provide security screws at exterior locations.
7. Mortar Guards: Provide guard boxes at back of hardware mortises in frames at all hinges and strike preps regardless of grouting requirements.
8. Floor Anchors: Weld anchors to bottom of jambs and mullions with at least four spot welds per anchor.
9. Jamb Anchors: Provide number and spacing of anchors as follows:

    a. Masonry Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:

        1) Two anchors per jamb up to 60 inches high.
        2) Three anchors per jamb from 60 to 90 inches high.
        3) Four anchors per jamb from 90 to 120 inches high.
        4) Four anchors per jamb plus 1 additional anchor per jamb for each 24 inches or fraction thereof above 120 inches high.

    b. Stud Wall Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:

        1) Three anchors per jamb up to 60 inches high.
        2) Four anchors per jamb from 60 to 90 inches high.
        3) Five anchors per jamb from 90 to 96 inches high.
        4) Five anchors per jamb plus 1 additional anchor per jamb for each 24 inches or fraction thereof above 96 inches high.
        5) Two anchors per head for frames above 42 inches wide and mounted in metal stud partitions.

10. Door Silencers: Except on weatherstripped or gasketed doors, drill stops to receive door silencers. Silencers to be supplied by frame manufacturer regardless if specified in Division 08 Section "Door Hardware".

E. Hardware Preparation: Factory prepare hollow metal work to receive template mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to the Door Hardware Schedule and templates furnished as specified in Division 08 Section "Door Hardware."

1. Locate hardware as indicated, or if not indicated, according to ANSI/SDI A250.8.
2. Reinforce doors and frames to receive non-template, mortised and surface mounted door hardware.
3. Comply with applicable requirements in ANSI/SDI A250.6 and ANSI/DHI A115 Series specifications for preparation of hollow metal work for hardware.
4. Coordinate locations of conduit and wiring boxes for electrical connections with Division 26 Sections.

2.12 STEEL FINISHES

A. Prime Finishes: Doors and frames to be cleaned, and chemically treated to insure maximum finish paint adhesion. Surfaces of the door and frame exposed to view to receive a factory applied coat of rust inhibiting shop primer.

1. Shop Primer: Manufacturer's standard, fast-curing, lead and chromate free primer complying with ANSI/SDI A250.10 acceptance criteria; recommended by primer manufacturer for substrate; and compatible with substrate and field-applied coatings.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. General Contractor to verify the accuracy of dimensions given to the steel door and frame manufacturer for existing openings or existing frames (strike height, hinge spacing, hinge back set, etc.).

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Remove welded in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces.

B. Prior to installation, adjust and securely brace welded hollow metal frames for squareness, alignment, twist, and plumbness.

C. Tolerances shall comply with SDI-117 "Manufacturing Tolerances Standard Steel Doors and Frames."

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D. Drill and tap doors and frames to receive non-template, mortised, and surface-mounted door hardware.

3.3 INSTALLATION

A. General: Install hollow metal work plumb, rigid, properly aligned, and securely fastened in place; comply with Drawings and manufacturer's written instructions.

B. Hollow Metal Frames: Install hollow metal frames of size and profile indicated. Comply with ANSI/SDI A250.11 and NFPA 80 at fire rated openings.

1. Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete and frames properly set and secured, remove temporary braces, leaving surfaces smooth and undamaged. Shim as necessary to comply with installation tolerances.

2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with post-installed expansion anchors.
3. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with mortar.
4. Grout Requirements: Do not grout head of frames unless reinforcing has been installed in head of frame. Do not grout vertical or horizontal closed mullion members.

C. Hollow Metal Doors: Fit hollow metal doors accurately in frames, within clearances specified below. Shim as necessary.

1. Non-Fire-Rated Standard Steel Doors:

a. Jambs and Head: 1/8 inch plus or minus 1/16 inch.
b. Between Edges of Pairs of Doors: 1/8 inch plus or minus 1/16 inch.
c. Between Bottom of Door and Top of Threshold: Maximum 3/8 inch.
d. Between Bottom of Door and Top of Finish Floor (No Threshold): Maximum 3/4 inch.

2. Fire-Rated Doors: Install doors with clearances according to NFPA 80.

D. Field Glazing: Comply with installation requirements in Division 08 Section "Glazing" and with hollow metal manufacturer's written instructions.

3.4 ADJUSTING AND CLEANING

A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including hollow metal work that is warped, bowed, or otherwise unacceptable.

B. Remove grout and other bonding material from hollow metal work immediately after installation.

C. Prime-Coat and Painted Finish Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat, or painted finishes, and apply touchup of compatible air drying, rust-inhibitive primer, zinc rich primer (exterior and galvanized openings) or finish paint.

END OF SECTION 08 11 10

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SECTION 08 31 10 - ACCESS DOORS AND FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:

1. Access doors and frames for walls and ceilings.

B. Related Sections include the following:

1. Division 03 Section "Cast-in-Place Concrete" for blocking out openings for access doors and frames in concrete.
2. Division 04 Section "Unit Masonry" for anchoring and grouting access door frames set in masonry construction.
3. Division 08 Section "Door Hardware" for mortise or rim cylinder locks and master keying.
4. Division 09 Section "Acoustical Tile Ceilings" for suspended acoustical tile ceilings.

1.3 SUBMITTALS

A. Product Data: For each type of access door and frame indicated. Include construction details, fire ratings, materials, individual components and profiles, and finishes.

B. Shop Drawings: Show fabrication and installation details of access doors and frames for each type of substrate. Include plans, elevations, sections, details, and attachments to other work.

C. Samples: For each door face material, at least 3 by 5 inches in size, in specified finish.

D. Access Door and Frame Schedule: Provide complete access door and frame schedule, including types, locations, sizes, latching or locking provisions, and other data pertinent to installation.

E. Ceiling Coordination Drawings: Reflected ceiling plans, drawn to scale, on which ceiling-mounted items including access doors and frames, lighting fixtures, diffusers, grilles, speakers, sprinklers, and special trim are shown and coordinated with each other.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain each type of access door(s) and frame(s) through one source from a single manufacturer.

B. Fire-Rated Access Doors and Frames: Units complying with NFPA 80 that are identical to access door and frame assemblies tested for fire-test-response characteristics per the following

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test method and that are listed and labeled by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:

1. NFPA 252 or UL 10B for vertical access doors and frames.
2. ASTM E 119 or UL 263 for horizontal access doors and frames.

C. Size Variations: Obtain Architect's acceptance of manufacturer's standard-size units, which may vary slightly from sizes indicated.

1.5 COORDINATION

A. Verification: Determine specific locations and sizes for access doors needed to gain access to concealed plumbing, mechanical, or other concealed work, and indicate in the schedule specified in "Submittals" Article.

PART 2 - PRODUCTS

2.1 STEEL MATERIALS

A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

1. ASTM A 123/A 123M, for galvanizing steel and iron products.
2. ASTM A 153/A 153M, for galvanizing steel and iron hardware.

B. Steel Sheet: cold-rolled steel sheet substrate complying with ASTM A 1008/A 1008M, Commercial Steel (CS), exposed.

C. Steel Finishes: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

1. Surface Preparation for Steel Sheet: Clean surfaces to comply with SSPC-SP 1, "Solvent Cleaning," to remove dirt, oil, grease, or other contaminants that could impair paint bond. Remove mill scale and rust, if present, from uncoated steel, complying with SSPC-SP 5/NACE No. 1, "White Metal Blast Cleaning," or SSPC-SP 8, "Pickling."
2. Factory-Primed Finish: Apply shop primer immediately after cleaning and pretreating.

D. Drywall Beads: Edge trim formed from 0.0299-inch zinc-coated steel sheet formed to receive joint compound and in size to suit thickness of gypsum board.

E. Plaster Beads: Casing bead formed from 0.0299-inch zinc-coated steel sheet with flange formed out of expanded metal lath and in size to suit thickness of plaster.

2.2 ACCESS DOORS AND FRAMES FOR WALLS AND CEILINGS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Acudor Products, Inc.
2. Babcock-Davis; A Cierra Products Co.
3. Bar-Co, Inc. Div.; Alfab, Inc.
4. Cendrex Inc.

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5. Dur-Red Products.
6. Elmdor/Stoneman; Div. of Acorn Engineering Co.
7. Jensen Industries.
8. J. L. Industries, Inc.
9. Karp Associates, Inc.
10. Larsen's Manufacturing Company.
11. MIFAB, Inc.
12. Milcor Inc.
13. Nystrom, Inc.
14. Williams Bros. Corporation of America (The).

B. Flush Access Doors and Frames with Exposed Trim: Fabricated from steel sheet.

1. Locations: Wall and ceiling surfaces.
2. Door: Minimum 0.060-inch-thick sheet metal, set flush with exposed face flange of frame.
3. Frame: Minimum 0.060-inch-thick sheet metal with 1-inch- wide, surface-mounted trim.
4. Hinges: Continuous piano.
5. Lock: Cylinder.

C. Fire-Rated, Insulated, Flush Access Doors and Frames with Exposed Trim: Fabricated from steel sheet.

1. Locations: Wall and ceiling surfaces.
2. Fire-Resistance Rating: Not less than that of adjacent construction.
3. Temperature Rise Rating: 250 deg F at the end of 30 minutes.
4. Door: Flush panel with a core of mineral-fiber insulation enclosed in sheet metal with a minimum thickness of 0.036 inch.
5. Frame: Minimum 0.060-inch-thick sheet metal with 1-inch-wide, surface-mounted trim.
6. Hinges: Continuous piano.
7. Automatic Closer: Spring type.
8. Lock: Self-latching device with cylinder lock.

2.3 FABRICATION

A. General: Provide access door and frame assemblies manufactured as integral units ready for installation. Provide stainless steel units at all wet areas such as washrooms, showers, and similar locations. Provide stainless steel units at Vehicle Bay areas.

B. Metal Surfaces: For metal surfaces exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.

C. Doors and Frames: Grind exposed welds smooth and flush with adjacent surfaces. Furnish attachment devices and fasteners of type required to secure access panels to types of supports indicated.

1. Exposed Flanges: Nominal 1 to 1-1/2 inches wide around perimeter of frame.
2. Provide mounting holes in frames for attachment of units to metal framing.
3. Provide mounting holes in frame for attachment of masonry anchors. Furnish adjustable metal masonry anchors.

D. Recessed Access Doors: Form face of panel to provide recess for application of applied finish. Reinforce panel as required to prevent buckling.

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E. Latching Mechanisms: Furnish number required to hold doors in flush, smooth plane when closed.

1. For cylinder lock, furnish two keys per lock and key all locks alike.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with manufacturer's written instructions for installing access doors and frames.

B. Set frames accurately in position and attach securely to supports with plane of face panels aligned with adjacent finish surfaces.

C. Install doors flush with adjacent finish surfaces or recessed to receive finish material.

3.2 ADJUSTING AND CLEANING

A. Adjust doors and hardware after installation for proper operation.

B. Remove and replace doors and frames that are warped, bowed, or otherwise damaged.

END OF SECTION 08 31 10

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SECTION 087100 – DOOR HARDWARE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes commercial door hardware for the following:

1. Swinging doors.
2. Other doors to the extent indicated.

B. Door hardware includes, but is not necessarily limited to, the following:

1. Mechanical door hardware.
2. Electromechanical door hardware, power supplies, back-ups and surge protection.
3. Cylinders specified for doors in other sections.

C. Related Sections:

1. Division 08 Section “Hollow Metal Doors and Frames”.

D. Codes and References: Comply with the version year adopted by the Authority Having Jurisdiction.

1. ANSI A117.1 - Accessible and Usable Buildings and Facilities.
2. ICC/IBC - International Building Code.
3. NFPA 70 - National Electrical Code.
4. NFPA 80 - Fire Doors and Windows.
5. NFPA 101 - Life Safety Code.
6. NFPA 105 - Installation of Smoke Door Assemblies.
7. State Building Codes, Local Amendments.

E. Standards: All hardware specified herein shall comply with the following industry standards:

1. ANSI/BHMA Certified Product Standards - A156 Series
2. UL10C – Positive Pressure Fire Tests of Door Assemblies

1.3 SUBMITTALS

A. Product Data: Manufacturer's product data sheets including installation details, material descriptions, dimensions of individual components and profiles, operational descriptions and finishes.

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B. Door Hardware Schedule: Prepared by or under the supervision of supplier, detailing fabrication and assembly of door hardware, as well as procedures and diagrams. Coordinate the final Door Hardware Schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.

1. Format: Comply with scheduling sequence and vertical format in DHI's "Sequence and Format for the Hardware Schedule."

2. Organization: Organize the Door Hardware Schedule into door hardware sets indicating complete designations of every item required for each door or opening. Organize door hardware sets in same order as in the Door Hardware Sets at the end of Part 3. Submittals that do not follow the same format and order as the Door Hardware Sets will be rejected and subject to resubmission.

3. Content: Include the following information:

a. Type, style, function, size, label, hand, and finish of each door hardware item.
b. Manufacturer of each item.
c. Fastenings and other pertinent information.
d. Location of door hardware set, cross-referenced to Drawings, both on floor plans and in door and frame schedule.
e. Explanation of abbreviations, symbols, and codes contained in schedule.
f. Mounting locations for door hardware.
g. Door and frame sizes and materials.

4. Submittal Sequence: Submit the final Door Hardware Schedule at earliest possible date, particularly where approval of the Door Hardware Schedule must precede fabrication of other work that is critical in the Project construction schedule. Include Product Data, Samples, Shop Drawings of other work affected by door hardware, and other information essential to the coordinated review of the Door Hardware Schedule.

C. Operating and Maintenance Manuals: Provide manufacturers operating and maintenance manuals for each item comprising the complete door hardware installation in quantity as required in Division 01, Closeout Submittals. The manual to include the name, address, and contact information of the manufacturers providing the hardware and their nearest service representatives. The final copies delivered after completion of the installation test to include "as built" modifications made during installation, checkout, and acceptance.

D. Warranties and Maintenance: Special warranties and maintenance agreements specified in this Section.

1.4 QUALITY ASSURANCE

A. Manufacturers Qualifications: Engage qualified manufacturers with a minimum 5 years of documented experience in producing hardware and equipment similar to that indicated for this Project and that have a proven record of successful in-service performance.

B. Installer Qualifications: Installers, trained by the primary product manufacturers, with a minimum 3 years documented experience installing both standard and electrified builders hardware similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.

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C. Door Hardware Supplier Qualifications: Experienced commercial door hardware distributors with a minimum 5 years documented experience supplying both mechanical and electromechanical hardware installations comparable in material, design, and extent to that indicated for this Project. Supplier recognized as a factory direct distributor in good standing by the manufacturers of the primary materials with a warehousing facility in Project's vicinity. Supplier to have on staff a certified Architectural Hardware Consultant (AHC) available during the course of the Work to consult with Contractor, Architect, and Owner concerning both standard and electromechanical door hardware and keying.

1. Scheduling Responsibility: Preparation of door hardware and keying schedules.

D. Source Limitations: Obtain each type and variety of Door Hardware specified in this Section from a single source, qualified supplier unless otherwise indicated.

E. Regulatory Requirements: Comply with NFPA 70, NFPA 80, NFPA 101 and ANSI A117.1 requirements and guidelines as directed in the model building code including, but not limited to, the following:

1. Where indicated to comply with accessibility requirements, comply with Americans with Disabilities Act (ADA), "Accessibility Guidelines for Buildings and Facilities (ADAAG)," ANSI A117.1 as follows:

a. Handles, Pulls, Latches, Locks, and other Operating Devices: Shape that is easy to grasp with one hand and does not require tight grasping, tight pinching, or twisting of the wrist.
b. Door Closers: Comply with the following maximum opening-force requirements indicated:

1) Interior Hinged Doors: 5 lbf applied perpendicular to door.
2) Fire Doors: Minimum opening force allowable by authorities having jurisdiction.

c. Thresholds: Not more than 1/2 inch high. Bevel raised thresholds with a slope of not more than 1:2.

2. NFPA 101: Comply with the following for means of egress doors:

a. Latches, Locks, and Exit Devices: Not more than 15 lbf to release the latch. Locks shall not require the use of a key, tool, or special knowledge for operation.

b. Thresholds: Not more than 1/2 inch high.

F. Each unit to bear third party permanent label demonstrating compliance with the referenced standards.

G. Pre-Submittal Conference: Conduct coordination conference in compliance with requirements in Division 01 Section "Project Meetings" with attendance by representatives of Supplier(s), Installer(s), and Contractor(s) to review proper methods and the procedures for receiving, handling, and installing door hardware.

1. Prior to installation of door hardware, conduct a project specific training meeting to instruct the installing contractors' personnel on the proper installation and adjustment of their respective products. Product training to be attended by installers of door hardware

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(including electromechanical hardware) for aluminum, hollow metal and wood doors. Training will include the use of installation manuals, hardware schedules, templates and physical product samples as required.

2. Inspect and discuss electrical roughing-in, power supply connections, and other preparatory work performed by other trades.
3. Review and finalize construction schedule and verify availability of materials.
4. Review the required inspecting, testing, commissioning, and demonstration procedures

H. At completion of installation, provide written documentation that components were applied to manufacturer's instructions and recommendations and according to approved schedule.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Inventory door hardware on receipt and provide secure lock-up and shelving for door hardware delivered to Project site. Do not store electronic access control hardware, software or accessories at Project site without prior authorization.

B. Tag each item or package separately with identification related to the final Door Hardware Schedule, and include basic installation instructions with each item or package.

C. Deliver, as applicable, permanent keys, cylinders, cores, access control credentials, software and related accessories directly to Owner via registered mail or overnight package service. Instructions for delivery to the Owner shall be established at the "Keying Conference".

1.6 COORDINATION

A. Templates: Obtain and distribute to the parties involved templates for doors, frames, and other work specified to be factory prepared for installing standard and electrified hardware. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing hardware to comply with indicated requirements.

B. Door and Frame Preparation: Related Division 08 Sections (Steel, Aluminum and Wood) doors and corresponding frames are to be prepared, reinforced and pre-wired (if applicable) to receive the installation of the specified electrified, monitoring, signaling and access control system hardware without additional in-field modifications.

1.7 WARRANTY

A. General Warranty: Reference Division 01, General Requirements. Special warranties specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

B. Warranty Period: Written warranty, executed by manufacturer(s), agreeing to repair or replace components of standard and electrified door hardware that fails in materials or workmanship within specified warranty period after final acceptance by the Owner. Failures include, but are not limited to, the following:

1. Structural failures including excessive deflection, cracking, or breakage.
2. Faulty operation of the hardware.
3. Deterioration of metals, metal finishes, and other materials beyond normal weathering.

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4. Electrical component defects and failures within the systems operation.

C. Standard Warranty Period: One year from date of Substantial Completion, unless otherwise indicated.

1.8 MAINTENANCE SERVICE

A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.

B. Continuing Service: Beginning at Substantial Completion, and running concurrent with the specified warranty period, provide continuous (6) months full maintenance including repair and replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper door opening operation. Provide parts and supplies as used in the manufacture and installation of original products.

PART 2 - PRODUCTS

2.1 SCHEDULED DOOR HARDWARE

A. General: Provide door hardware for each door to comply with requirements in Door Hardware Sets and each referenced section that products are to be supplied under.

1. Designations: Requirements for quantity, item, size, finish or color, grade, function, and other distinctive qualities of each type of door hardware are indicated in the Door Hardware Sets at the end of Part 3. Products are identified by using door hardware designations, as follows:

a. Named Manufacturer's Products: Product designation and manufacturer are listed for each door hardware type required for the purpose of establishing requirements. Manufacturers' names are abbreviated in the Door Hardware Schedule.

B. Substitutions: Requests for substitution and product approval for inclusive mechanical and electromechanical door hardware in compliance with the specifications must be submitted in writing and in accordance with the procedures and time frames outlined in Division 01, Substitution Procedures. Approval of requests is at the discretion of the architect, owner, and their designated consultants.

2.2 HANGING DEVICES

A. Hinges: ANSI/BHMA A156.1 certified butt hinges with number of hinge knuckles as specified in the Door Hardware Sets.

1. Quantity: Provide the following hinge quantity, unless otherwise indicated:

a. Two Hinges: For doors with heights up to 60 inches.
b. Three Hinges: For doors with heights 61 to 90 inches.

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c. Four Hinges: For doors with heights 91 to 120 inches.
d. For doors with heights more than 120 inches, provide 4 hinges, plus 1 hinge for every 30 inches of door height greater than 120 inches.

2. Hinge Size: Provide the following, unless otherwise indicated, with hinge widths sized for door thickness and clearances required:

a. Widths up to 3'0": 4-1/2" standard or heavy weight as specified.
b. Sizes from 3'1" to 4'0": 5" heavy weight.

3. Hinge Weight and Base Material: Unless otherwise indicated, provide the following

a. Interior Doors: Standard weight, steel, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate heavy weight.

4. Acceptable Manufacturers:

a. Hager Companies (HA).
b. McKinney Products (MK).
c. Stanley Hardware (ST).

2.3 DOOR OPERATING TRIM

A. Door Push Plates and Pulls: ANS/BHMA A156.6 certified door pushes and pulls of type and design specified below or in the Hardware Sets. Coordinate and provide proper width and height as required where conflicting hardware dictates.

1. Push/Pull Plates: Minimum .050 inch thick, size as indicated in hardware sets, with beveled edges, secured with exposed screws unless otherwise indicated.
2. Door Pull and Push Bar Design: Size, shape, and material as indicated in the hardware sets. Minimum clearance of 2 1/2-inches from face of door unless otherwise indicated.
3. Offset Pull Design: Size, shape, and material as indicated in the hardware sets. Minimum clearance of 2 1/2-inches from face of door and offset of 90 degrees unless otherwise indicated.
4. Fasteners: Provide manufacturer's designated fastener type as indicated in Hardware Sets.

a. Acceptable Manufacturers:

1) Burns Manufacturing (BU).
2) Rockwood Manufacturing (RO).
3) Trimco (TC).

2.4 DOOR CLOSERS

A. All door closers specified herein shall meet or exceed the following criteria:

1. General: Door closers to be from one manufacturer, matching in design and style, with the same type door preparations and templates regardless of application or spring size. Closers to be non-handed with full sized covers including installation and adjusting information on inside of cover.

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2. Standards: Closers to comply with UL-10C and UBC 7-2 for Positive Pressure Fire Test and be U.L. listed for use of fire rated doors.

3. Cycle Testing: Provide closers which have surpassed 15 million cycles in a test witnessed and verified by UL.

4. Size of Units: Comply with manufacturer's written recommendations for sizing of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Where closers are indicated for doors required to be accessible to the physically handicapped, provide units complying with ANSI ICC/A117.1.

5. Closer Arms: Provide heavy duty, forged steel closer arms unless otherwise indicated in Hardware Sets.

   a. Where closers are indicated to have mechanical dead-stop, provide heavy duty arms and brackets with an integral positive stop.
   b. Where closers are indicated to have mechanical hold open, provide heavy duty units with an additional built-in mechanical holder assembly designed to hold open against normal wind and traffic conditions. Holder to be manually selectable to on-off position.
   c. Where closers are indicated to have a cushion-type stop, provide heavy duty arms and brackets with spring stop mechanism to cushion door when opened to maximum degree.
   d. Closers shall not be installed on exterior or corridor side of doors; where possible install closers on door for optimum aesthetics. Provide drop plates or other accessories as required for proper mounting.

6. Closer Accessories: Provide door closer accessories including custom templates, special mounting brackets, spacers and drop plates as required for proper mounting.

B. Door Closers, Surface Mounted (Heavy Duty): ANSI/BHMA A156.4, Grade 1 surface mounted, heavy duty door closers with complete spring power adjustment, sizes 1 thru 6; and fully operational adjustable according to door size, frequency of use, and opening force. Closers to be rack and pinion type, one piece cast iron or aluminum alloy body construction, with adjustable backcheck and separate non-critical valves for closing sweep and latch speed control. Provide non-handed units standard.

   1. Acceptable Manufacturers:

      a. Corbin Russwin Hardware (RU) - DC8000 Series.
      b. LCN Closers (LC) - 4040XP Series.
      c. Sargent Manufacturing (SA) - 351 Series.
      d. Norton Door Controls (NO) - 7500 Series.

2.5 ARCHITECTURAL TRIM

A. Door Protective Trim

   1. General: Door protective trim units to be of type and design as specified below or in the Hardware Sets.

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2. Size: Fabricate protection plates (kick, armor, or mop) not more than 2" less than door width (LDW) on stop side of single doors and 1” LDW on stop side of pairs of doors, and not more than 1" less than door width on pull side. Coordinate and provide proper width and height as required where conflicting hardware dictates. Height to be as specified in the Hardware Sets.

3. Metal Protection Plates: ANSI/BHMA A156.6 certified metal protection plates (kick, armor, or mop), beveled on four edges (B4E), fabricated from the following:

   a. Stainless Steel: 300 series, 050-inch thick, with countersunk screw holes (CSK).

4. Fasteners: Provide manufacturer's designated fastener type as specified in the Hardware Sets.

5. Metal Door Edging: Door protection edging fabricated from a minimum .050-inch thick metal sheet, formed into an angle or "U" cap shapes, surface or mortised mounted onto edge of door. Provide appropriate leg overlap to account for protection plates as required. Height to be as specified in the Hardware Sets.

6. Acceptable Manufacturers:

   a. Burns Manufacturing (BU).
   b. Rockwood Manufacturing (RO).
   c. Trimco (TC).

2.6 DOOR STOPS AND HOLDERS

A. General: Door stops and holders to be of type and design as specified below or in the Hardware Sets.

B. Door Stops and Bumpers: ANSI/BHMA A156.16, Grade 1 certified door stops and wall bumpers. Provide wall bumpers, either convex or concave types with anchorage as indicated, unless floor or other types of door stops are specified in Hardware Sets. Do not mount floor stops where they will impede traffic. Where floor or wall bumpers are not appropriate, provide overhead type stops and holders.

   1. Acceptable Manufacturers:

      a. Burns Manufacturing (BU).
      b. Rockwood Manufacturing (RO).
      c. Trimco (TC).

2.7 ARCHITECTURAL SEALS

A. General: Thresholds, weatherstripping, and gasket seals to be of type and design as specified below or in the Hardware Sets. Provide continuous weatherstrip gasketing on exterior doors and provide smoke, light, or sound gasketing on interior doors where indicated. At exterior applications provide non-corrosive fasteners and elsewhere where indicated.

B. Sound-Rated Gasketing: Assemblies that are listed and labeled by a testing and inspecting agency, for sound ratings indicated, based on testing according to ASTM E 1408.

C. Replaceable Seal Strips: Provide only those units where resilient or flexible seal strips are easily replaceable and readily available from stocks maintained by manufacturer.

D. Acceptable Manufacturers:

1. Pemko Manufacturing (PE).
2. Reese Enterprises, Inc. (RS).
3. Zero International (ZE).

2.8 FABRICATION

A. Fasteners: Provide door hardware manufactured to comply with published templates generally prepared for machine, wood, and sheet metal screws. Provide screws according to manufacturers recognized installation standards for application intended.

2.9 FINISHES

A. Standard: Designations used in the Hardware Sets and elsewhere indicate hardware finishes complying with ANSI/BHMA A156.18, including coordination with traditional U.S. finishes indicated by certain manufacturers for their products.

B. Provide quality of finish, including thickness of plating or coating (if any), composition, hardness, and other qualities complying with manufacturer's standards, but in no case less than specified by referenced standards for the applicable units of hardware.

C. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine scheduled openings, with Installer present, for compliance with requirements for installation tolerances, labeled fire door assembly construction, wall and floor construction, and other conditions affecting performance.

B. Notify architect of any discrepancies or conflicts between the door schedule, door types, drawings and scheduled hardware. Proceed only after such discrepancies or conflicts have been resolved in writing.

3.2 PREPARATION

A. Hollow Metal Doors and Frames: Comply with ANSI/DHI A115 series.

B. Install each item of mechanical and electromechanical hardware and access control equipment to comply with manufacturer's written instructions and according to specifications.

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1. Installers are to be trained and certified by the manufacturer on the proper installation and adjustment of fire, life safety, and security products including: hanging devices; locking devices; closing devices; and seals.

C. Mounting Heights: Mount door hardware units at heights indicated in following applicable publications, unless specifically indicated or required to comply with governing regulations:

1. Standard Steel Doors and Frames: DHI's "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."
2. Where indicated to comply with accessibility requirements, comply with ANSI A117.1 "Accessibility Guidelines for Buildings and Facilities."
3. Provide blocking in drywall partitions where wall stops or other wall mounted hardware is located.

D. Thresholds: Set thresholds for exterior and acoustical doors in full bed of sealant complying with requirements specified in Division 7 Section "Joint Sealants."

3.3 FIELD QUALITY CONTROL

A. Field Inspection: Supplier will perform a final inspection of installed door hardware and state in report whether work complies with or deviates from requirements, including whether door hardware is properly installed, operating and adjusted.

3.4 ADJUSTING

A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

3.5 CLEANING AND PROTECTION

A. Protect all hardware stored on construction site in a covered and dry place. Protect exposed hardware installed on doors during the construction phase. Install any and all hardware at the latest possible time frame.

B. Clean operating items as necessary to restore proper finish. and provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of owner occupancy.

END OF SECTION 08 71 00

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SECTION 09 22 20 - NON-STRUCTURAL METAL FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 DESCRIPTION OF WORK:

A. The types of metal stud systems required include:
   1. Screw-type steel studs for drywall work.
   2. Suspension system for interior gypsum board ceilings, soffits and grid systems.

1.3 RELATED WORK UNDER OTHER SECTIONS:

A. Division 07 Section “Sound Attenuation Batts”

B. Division 07 Section “Thermal Insulation”

C. Division 09 Section “Gypsum Board.”

D. Division 13 Section “Metal Building System”

E. Division 26 Section - Metal or plastic grommets to protect electric cable and wire.

1.4 SUBMITTALS:

A. Product Data: For information only, submit copies of manufacturer's specifications and installation instructions for each type of metal stud and accessories including other data as may be required to show compliance with these specifications.

1.5 QUALITY ASSURANCE:

A. U.L. Rated Assemblies: Where metal studs are components of assemblies indicated for a fire-resistance rating, including those required for compliance with governing regulations, provide studs identical with units, tested and shown in the applicable UL design of the "Fire Resistance Index" and Gypsum Association “GA-600” latest edition..

B. Manufacturer: Provide steel studs, of the type(s) indicated, produced by one of the following:

   1. Punched-type non-load-bearing curtain wall studs:

      a. Marino Corporation
      b. Dietrich Industries

   2. Screw-type lightgage drywall studs:

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a. Marino Corporation
b. Dietrich Industries

1.6 PRODUCT DELIVERY AND STORAGE:

A. Protect metal studs from rusting and damage. Deliver to the project site in manufacturer's unopened containers or bundles, fully identified with name, brand, type and grade. Store off the ground in a dry ventilated space.

PART 2 - PRODUCTS

2.1 GENERAL:

A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

B. Installation standard ASTM C 754.

C. System Components: With each type of metal stud required, provide manufacturer's standard runners (tracks), shoes, clips, ties, stiffeners, fasteners, door jamb reinforcers and accessories as recommended by the manufacturer for the applications indicated, to provide a complete metal stud system.

D. Punched Steel Non-Load-Bearing Studs: Manufacturer's standard formed steel studs of the height, depth, shape and gage indicated; and with the section modulus indicated, if any; with punched webs to facilitate erection of system and passage of mechanical/electrical service lines.

1. Gage: As scheduled.
2. Depth of Section: As shown.
3. Steel: ASTM A 570, Grade D (40,000 psi yield strength).
4. Finish: Hot-dip zinc coating complying with ASTM A 525, G90.
5. Face of Flanges: Screw type (knurled to facilitate use of self-drilling tapping fasteners).

E. Drywall Screw-Type Steel Studs: Manufacturer's standard formed lightgage steel studs complying with ASTM C 645, of the height, size, and gage indicated; with punched webs to facilitate erection of system and passage of mechanical/electrical service lines.

1. Gage: 25 gage minimum, however, provide 20 gage studs in unbraced partitions over 10 feet in height, and at certain door jambs hereinafter specified.
2. Provide 20 gage or heavier studs at partitions indicated to receive fiberglass reinforced cementitious board, and at gypsum drywall partitions indicated to be finished with ceramic tile.
3. Provide 18 gage or heavier studs at walls indicated to receive Security Mesh.
4. Depth of Section: As indicated.
5. Flange Width: Not less than 1.25".
6. Shape: "Cee" shape (returned flanges).
7. Steel and Finish: ASTM A 591 Commercial Quality electrolytic zinc coated steel, Class B.
8. Humid Exposures: Where studs are located in exterior walls, provide hot-dip zinc coating complying with ASTM A 525, G90.
9. Face of Flanges: Screw-type (knurled to facilitate use of self-drilling tapping fasteners).

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F. Miscellaneous Metal Accessories: Provide 3/4" channels, 7/8" furring members or miscellaneous furring items, as indicated and required.

G. Suspension Systems:

1. Tie-wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.062-inch (1.59 mm) diameter wire, or double strand of 0.048-inch (1.21 mm) diameter wire.
2. Hanger Attachments to Concrete:

a. Anchors: Capable of sustaining a load equal to 5 times that imposed as determined by ASTM E 488.
b. Powder-Actuated Fasteners: Capable of sustaining, a load equal to 10 times that imposed as determined by ASTM E 1190.

3. Wire Hangers: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.16-inch (4.12 mm) in diameter.
4. Carrying Channels: Cold-rolled, commercial-steel sheet with a base-metal thickness of 0.053-inch (1.34 mm) and minimum 1/2 inch wide flanges.

a. Depth: As indicated on drawings, if not indicated provide 2 inches (51 mm).

5. Furring Channels (Furring Members):

a. Cold-Rolled Channels: 0.053-inch (1.34 mm) uncoated-steel thickness, with minimum 1/2 inch (13 mm) wide flanges, 3/4 inch (19 mm) deep.
b. Steel Studs and Runners: ASTM C 645. Use either steel studs and runners or dimpled steel studs and runners of equivalent minimum base-metal thickness.

1) Minimum Base-Metal Thickness: As indicated on drawings. If not indicated, not less than 22 gauge.
2) Depth: As indicated on drawings. If not indicated depth should be not less than 2-1/2 inches (64 mm).

6. Hat-Shaped, Rigid Furring Channels: ASTM C 645, 7/8-inch (22 mm) deep.

a. Minimum Base-Metal Thickness: As indicated on drawings. If not indicated, thickness should be not less than 25 gauge.

7. Resilient Furring Channels: 1/2-inch (13 mm) deep members designed to reduce sound transmission.

a. Configuration: Hat shaped.

PART 3 - EXECUTION

3.1 INSTALLATION:

A. General:

1. Manufacturer's Instructions: Install metal stud systems in accordance with manufacturer's printed or written instructions and recommendations.
2. ANSI Standards: Comply with applicable requirements of ANSI A 42.3 and A 42.4, except where more detailed or more stringent requirements are indicated.

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3. Gypsum Association Specifications: Comply with the requirements and recommendations of GA-203 latest edition "Installation of Screw-Type Steel Framing Members to Receive Gypsum board", where metal studs are indicated to receive gypsum board.

    a. Coordinate requirements and recommendations with GA-600 latest edition for wall construction type and/or sound ratings.

4. ML/SFA Specifications: Comply with the requirements and recommendations of "Specifications for Metal Lathing and Furring" by the Metal Lath/Steel Framing Association, where metal studs are indicated to receive metal lath and plaster.
5. Runner Tracks: Install continuous tracks sized to match studs. Align tracks accurately to the layout at base and tops of studs. Secure tracks for the type of construction involved, except do not exceed 24" o.c. spacing for nail or power-driven fasteners, nor 16" o.c. for other types of attachment. Provide fasteners at corners and ends of tracks.

    a. Isolation of Stud Systems from Structures: Where stud systems abut ceiling or deck construction or vertical structural elements, provide slip or cushion-type joint between stud system and structure to prevent the transfer of structural loads or movements to stud systems, unless otherwise shown.

6. Set studs plumb, except as needed for diagonal bracing or required for non-plumb walls or warped surfaces and similar requirements.
7. Where stud system abuts structural columns or walls, including masonry walls, anchor ends of stiffeners to supporting structure.
8. Where wire-tying is indicated for assembly of stud system components, tie with either single 16 gage or double 18 gage wire except as otherwise indicated. Wrap to form either saddle-tie or figure-eight, depending upon type of member intersection.
9. Install supplementary framing, blocking and bracing in the metal stud system where walls or partitions are indicated to support fixtures, equipment, services, casework, heavy trim and furnishings and similar work requiring attachment to the wall or partition. Where type of supplementary support is not indicated, comply with the stud manufacturer's recommendations and industry standards in each case, considering the weight or loading resulting from the item supported. In addition, provide horizontal bracing in all partitions 8'-0" high or greater, whether or not required by the stud manufacturer.
10. Height of Partition Stud Systems: Terminate top of all partitions at underside of construction above, unless shown otherwise.
11. Stud Spacing: Space studs at 16" o.c., maximum, install studs so flanges within framing system, point in same direction.

B. Installation of Exterior Curtain Wall Stud System:

1. Secure studs to top and bottom runner tracks by either welding or screw fastening at both inside and outside flanges, or provide manufacturer's special stud shoes or clips for stud anchorage.
2. Frame wall openings larger than 2'-0" square with double stud at each jamb of frame except where more than two are either shown or indicated in manufacturer's instructions. Install runner tracks and jack studs above and below wall openings. Anchor tracks to jamb studs with stud shoes or by welding, and space jack studs same as full-height studs of the wall. Install at least one stiffener above and below each wall opening, not more than 6" above head and 6" below sill. Extend stiffeners to not less than 2 regular studs each side of jamb studs, and weld or wire-tie to each stud and jack stud intersected. Secure stud system all around to wall opening frame in the manner indicated.
3. Frame both sides of expansion and control joints, as shown for the wall system, with a separate stud and do not bridge the joint with components of the stud system.

C. Installation of Stud System to Receive Gypsum Board:

1. Runner Tracks: At partition corners and intersections, butt runner tracks, except leave clearance where base course of gypsum board is to run through.
2. Friction fit studs to runner tracks by positioning and rotating into place. Provide positive attachment to tracks for studs located at partition corners and intersections, and adjacent to openings, and for jack studs located above and below openings. Attach with either self-tapping screws or by use of clinching tool, at both flanges of stud.
3. At partition corners and intersections, provide a minimum of 3 studs, positioned to support each surface of partition; or provide 2 studs with the second stud installed after the base course of gypsum board has been run through, and screw anchor the second stud through the gypsum board to the first stud at 2' o.c. spacing.
4. Install full length studs between runner tracks wherever possible. If necessary, splice studs by nesting with a minimum lap of 8" and fasten laps with 2 screws through each flange.
5. Frame door openings with vertical studs securely attached to each jamb of door frame. On head of door frame install runner track; cut flanges at ends, bend web 90 degrees and screw attach to jamb studs. Install jack studs over door opening, spaced same as full-height studs. Where control joints are shown to extend upward from door jambs, install an unattached cripple stud spaced 1/2" from jamb or strut stud(s). Space next full-height stud not more than 6" from jamb or strut stud(s).

    a. Provide jamb stud(s) at swing/hinged-door openings as follows:

        1) Door widths up to 4'-0" - 2-25 gage or 1-20 gage
        2) Door opening in excess of 4' - 2-20 gage

    b. Attach jamb studs to metal door frames with metal clips, each with two screws into jamb stud.

6. Frame openings other than door openings in the same manner as required for door openings, and install framing below sills of openings to match framing required above door heads.
7. Frame both sides of expansion and control joints as shown for the partition system, with a separate stud and do not bridge the joint with components of the stud system.

D. Installation of Suspension Stud System to Receive Gypsum Board:

1. Install suspension system components according to spacings indicated, but not greater than spacings required by reference installation standards for assembly types.
2. Isolate suspension systems from building structure where they abut or are penetrated by building structure to prevent transfer of loading imposed by structural movement.
3. Suspend hangers from building structure as follows:

    a. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or suspension system.

        1) Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.

    b. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with locations of hangers, install supplemental suspension members and hangers in the form of trapezes or equivalent devices.
    c. Do not attach hangers to steel roof deck.
    d. Do not attach hangers to permanent metal forms. Furnish cast-in-place hanger inserts that extend through forms.
    e. Do not attach hangers to rolled-in hanger tabs of composite steel floor deck.

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f. Do not connect or suspend steel framing from ducts, pipes, or conduit.

4. Fire-Resistance-Rated Assemblies: Wire tie furring channels to supports.
5. Seismic Bracing: Sway-brace suspension systems with hangers used for support at 8'-0" o.c. each way.
6. Installation Tolerances: Install suspension systems that are level to within 1/8 inch in 12 feet (3 mm in 3.6 m) measured lengthwise on each member that will receive finishes and transversely between parallel members that will receive finishes.

E. Z-Furring Members:

1. Erect insulation, specified in Division 07 Section "Thermal Insulation," vertically and hold in place with Z-furring members spaces 24 inches o.c.
2. Except at exterior corners, securely attach narrow flanges of furring members to wall with concrete stub nails, screws designed for masonry attachment, or power-driven fasteners spaced 24 inches o.c.
3. At exterior corners, attach wide flange of furring members to wall with short flange extending beyond corner; on adjacent wall surface, screw-attach short flange of furring channel to web of attached channel. At interior corners, space second member no more than 12 inches from corner and cut insulation to fit.

END OF SECTION 09 22 20

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SECTION 09 29 00 - GYPSUM BOARD

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

B. American Society for Testing and Materials (ASTM):
   1. ASTM C 840 Standard Specification for Application and Finishing of Gypsum Board

C. Gypsum Association (GA)
   1. GA-216 Application and Finishing of Gypsum Board

1.2 SUMMARY

A. Section Includes:

   1. Interior gypsum board.
   2. Tile backing panels.
   3. Hi-Abuse Gypsum drywall applied to screw type metal support systems.
   4. Gypsum drywall for ceiling applications.

B. Related Requirements:

   1. Division 07 Section “Sound Attenuation Batts”

   2. Division 09 Section "Non-Structural Metal Framing" for non-structural framing and suspension systems that support gypsum board panels.

1.3 ACTION SUBMITTALS

A. Product Data: For information only, submit copies of manufacturer's product specifications and installation instructions for each gypsum drywall components, including other data as may be required to show compliance with these specifications.

B. Certification: Submit certification that proposed materials conform to the Fire Test Data of ASTM E 84.

C. Samples: For the following products:
   1. Trim Accessories: Full-size Sample in 12-inch- (300-mm-) long length for each trim accessory indicated.

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1.4 QUALITY ASSURANCE

A. Fire-Resistance Rating: Where work is indicated for fire-resistance ratings, including those required to comply with governing regulations, provide materials and installations identical with applicable assemblies tested and listed by recognized authorities, including U.L. and A.I.A.

B. Industry Standard: Comply with applicable requirements of GA-216 "Application and Finishing of Gypsum Board" by the Gypsum Association, except where more detailed or more stringent requirements are indicated including the recommendations of the manufacturer.

C. Allowable Tolerances: 1/8" offsets between planes of board faces, and 1/4" in 8'-0" for plumb, level, warp and bow.

D. Mockups: Before beginning gypsum board installation, install mockups of at least 100 sq. ft. (9 sq. m) in surface area to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Install mockups for the following:
   a. Each level of gypsum board finish indicated for use in exposed locations.
2. Apply or install final decoration indicated, including painting and wallcoverings, on exposed surfaces for review of mockups.
3. Simulate finished lighting conditions for review of mockups.
4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.5 DELIVERY, STORAGE AND HANDLING

A. Deliver gypsum drywall materials in sealed containers and bundles, fully identified with manufacturer's name, brand, type and grade Store materials inside under cover and keep them dry and protected against weather, condensation, direct sunlight, construction traffic, and other potential causes of damage. Stack panels flat and supported on risers off the ground on a flat platform to prevent sagging.

1.6 FIELD CONDITIONS

A. Environmental Limitations: Comply with ASTM C 840 and GA-216 requirements or gypsum board manufacturer's written recommendations, whichever are more stringent.

B. Examine the substrates and the spaces to receive gypsum drywall, and the conditions under which gypsum drywall is to be installed; and do not proceed with the installation until unsatisfactory conditions have been corrected.

C. Maintain ambient temperatures at not less than 55 degrees F., for the period of 24 hours before drywall finishing, during installation and until compounds are dry.

D. Do not install paper-faced gypsum panels until installation areas are enclosed and conditioned.

E. Do not install panels that are wet, those that are moisture damaged, and those that are mold damaged.

1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.

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2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency.

B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.

C. Low-Emitting Materials: For ceiling and wall assemblies, provide materials and construction identical to those tested in assembly and complying 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."

2.2 GYPSUM BOARD, GENERAL

A. Recycled Content of Gypsum Panel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 20 percent.

B. Size: Provide maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

2.3 INTERIOR GYPSUM BOARD

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

1. American Gypsum.
2. CertainTeed Corp.
3. Georgia-Pacific Gypsum LLC.
4. Lafarge North America Inc.
5. National Gypsum Company.
6. USG Corporation.

B. General: Comply with GA-216 ASTM C 1396/C 1396M.

C. Gypsum Wallboard:

1. Thickness: 5/8 inch (12.7 mm).
2. Long Edges: Tapered.

D. Gypsum Board, Type X: ASTM C 1396/C 1396M.

1. Thickness: 5/8 inch (15.9 mm).
2. Long Edges: Tapered.

E. Flexible Gypsum Board: ASTM C 1396/C 1396M. Manufactured to bend to fit radii and to be more flexible than standard regular-type gypsum board of same thickness.

1. Thickness: 1/4 inch (6.4 mm).
2. Long Edges: Tapered.

F. Gypsum Ceiling Board: ASTM C 1396/C 1396M.

1. Thickness: 5/8 inch (12.7 mm).
2. Long Edges: Tapered.

G. Abuse-Resistant Type: Manufactured to produce greater resistance to surface indentation, through-penetration (impact resistance), and abrasion than standard, regular-type and Type X gypsum board.

1. Core: 5/8 inch, Type X.
2. Long Edges: Tapered.

H. Moisture- and Mold-Resistant Gypsum Board: ASTM C 1396/C 1396M. With moisture- and mold-resistant core and paper surfaces.

1. Core: As indicated, 5/8 inch (15.9 mm), Type X, unless otherwise noted.
2. Long Edges: Tapered.
3. Mold Resistance: ASTM D 3273, score of 10.

2.4 EXTERIOR GYPSUM BOARD FOR CEILINGS AND SOFFITS

A. Exterior Gypsum Soffit Board: ASTM C 1396/C 1396M, with manufacturer's standard edges.

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 Gypsum.
b. CertainTeed Corp.
c. Georgia-Pacific Gypsum LLC.
d. Lafarge North America Inc.
e. National Gypsum Company.
f. PABCO Gypsum.
g. Temple-Inland.
h. USG Corporation.

2. Core: As indicated, 5/8 inch (15.9 mm), Type X, unless otherwise noted.

B. Glass-Mat Gypsum Sheathing Board: ASTM C 1177/C 1177M, with fiberglass mat laminated to both sides and with manufacturer's standard edges.

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

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a. CertainTeed Corp.; GlasRoc Sheathing.
b. Georgia-Pacific Gypsum LLC; Dens-Glass Gold.
c. National Gypsum Company; Gold Bond, e(2)XP.
d. USG Corporation; Securock Glass Mat Sheathing.

2. Core: As indicated, 5/8 inch (15.9 mm), Type X, unless otherwise noted.

2.5 TILE BACKING PANELS

A. Glass-Mat, Water-Resistant Backing Board: ASTM C 1178/C 1178M, with manufacturer's standard edges.

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

a. CertainTeed Corp.; GlasRoc Tile Backer.
b. Georgia-Pacific Gypsum LLC; DensShield Tile Backer.

2. Core: As indicated on Drawings, 5/8 inch (15.9 mm), Type X, unless otherwise noted.
3. Mold Resistance: ASTM D 3273, score of 10.

B. Water-Resistant Gypsum Backing Board: ASTM C 1396/C 1396M, with manufacturer's standard edges.

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 Gypsum.
b. CertainTeed Corp.
c. Georgia-Pacific Gypsum LLC.
d. Lafarge North America Inc.
e. PABCO Gypsum.
f. Temple-Inland.
g. USG Corporation.

2. Core: As indicated on Drawings 5/8 inch (15.9 mm), Type X, unless otherwise noted.

2.6 TRIM ACCESSORIES

A. Interior Trim: ASTM C 1047.

1. Material: Galvanized steel sheet, rolled zinc, plastic, or paper-faced galvanized steel sheet.
2. Shapes:

a. Corner bead.
b. Bullnose bead.
c. Casing bead / LC-Bead: J-shaped; exposed long flange receives joint compound.
d. L-Bead: L-shaped; exposed long flange receives joint compound.
e. U-Bead: J-shaped; exposed short flange does not receive joint compound.
f. Expansion (control) joint.

g. Curved-Edge corner bead: With notched or flexible flanges.

B. Exterior Trim: ASTM C 1047.

1. Material: Hot-dip galvanized steel sheet.
2. Shapes:

a. Corner bead.
b. LC-Bead: J-shaped; exposed long flange receives joint compound.
c. Expansion (Control) Joint: One-piece, rolled zinc with V-shaped slot and removable strip covering slot opening.

2.7 JOINT TREATMENT MATERIALS

A. General: Comply with ASTM C 475/C 475M.

B. Joint Tape:

1. Interior Gypsum Board: Paper.
2. Exterior Gypsum Soffit Board: Paper.
3. Glass-Mat Gypsum Sheathing Board: 10-by-10 glass mesh.
4. Tile Backing Panels: As recommended by panel manufacturer.

C. Joint Compound for Interior Gypsum Board: For each coat use formulation that is compatible with other compounds applied on previous or for successive coats.

1. Prefilling: At open joints, rounded edges, and damaged surface areas, use setting-type taping compound.
2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use drying-type, all-purpose compound.

a. Use setting-type compound for installing paper-faced metal trim accessories.

3. Fill Coat: For second coat, use drying-type, all-purpose compound.
4. Finish Coat: For third coat, use drying-type, all-purpose compound.
5. Skim Coat: For final coat of Level 5 finish, use high-build interior coating product designed for application by airless sprayer and to be used instead of skim coat to produce Level 5 finish.

D. Joint Compound for Exterior Applications:

1. Exterior Gypsum Soffit Board: Use setting-type taping compound and setting-type, sandable topping compound.
2. Glass-Mat Gypsum Sheathing Board: As recommended by sheathing board manufacturer.

E. Joint Compound for Tile Backing Panels:

1. Glass-Mat, Water-Resistant Backing Panel: As recommended by backing panel manufacturer.
2. Cementitious Backer Units: As recommended by backer unit manufacturer.
3. Water-Resistant Gypsum Backing Board: Use setting-type taping compound and setting-type, sandable topping compound.

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2.8 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written recommendations.

B. Expansion Joints: Rigid vinyl, 1-1/2" wide, 10' lengths, with removable flexible vinyl strip.

C. Suspended Drywall Ceiling System: Heavy-duty system, as manufactured by Donn, Chicago, Roper, or drywall manufacturer.

D. Laminating Adhesive: Adhesive or joint compound recommended for directly adhering gypsum panels to continuous substrate.

1. Laminating adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

E. Steel Drill Screws: ASTM C 1002, unless otherwise indicated.

1. Use screws complying with ASTM C 954 for fastening panels to steel members from 0.033 to 0.112 inch (0.84 to 2.84 mm) thick.
2. For fastening cementitious backer units, use screws of type and size recommended by panel manufacturer.

F. Sound Attenuation Blankets: ASTM C 665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.

1. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly.
2. Provide Insul-Hold fasteners to secure insulation in place. Install in accordance with manufacturers specifications. Install 6" below top of insulation and at 4'-0" above floor. Option: Use strip or individual units.
3. Recycled Content of Blankets: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 20 percent.

G. Acoustical Joint Sealant: Manufacturer's standard non-sag, paintable, non-staining latex sealant complying with ASTM C 834. Product effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.

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. Accumetric LLC; BOSS 824 Acoustical Sound Sealant.
b. Grabber Construction Products; Acoustical Sealant GSC.
c. Pecora Corporation; AC-20 FTR.
d. Specified Technologies, Inc.; Smoke N Sound Acoustical Sealant.
e. USG Corporation; SHEETROCK Acoustical Sealant.

2. 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).

H. Thermal Insulation: As specified in Division 07 Section "Thermal Insulation."

I. Vapor Retarder: As specified in Division 07 Section "Thermal Insulation."

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PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and substrates including welded hollow-metal frames and framing, with Installer present, for compliance with requirements and other conditions affecting performance.

B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLYING AND FINISHING PANELS, GENERAL

A. Comply with ASTM C 840.

B. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in central area of each ceiling. Stagger abutting end joints of adjacent panel's not less than one framing member.

C. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch (1.5 mm) of open space between panels. Do not force into place.

D. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.

E. Form control and expansion joints with space between edges of adjoining gypsum panels. Control joints to be installed minimum 24'-0" o.c. until noted otherwise.

F. Cover both faces of support framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.

1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. (0.7 sq. m) in area.
2. Fit gypsum panels around ducts, pipes, and conduits.
3. Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow 1/4- to 3/8- inches- (6.4- to 9.5-mm-) wide joints to install sealant.

G. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments, except floors. Provide 1/4- to 1/2- inches- (6.4- to 12.7-mm-) wide spaces at these locations and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.

H. Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.

I. STC-Rated Assemblies: Seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both

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faces of partitions at perimeters and through penetrations. Comply with ASTM C 919 and with manufacturer's written recommendations for locating edge trim and closing off sound-flanking paths around or through assemblies, including sealing partitions above acoustical ceilings.

J. Install sound attenuation blankets before installing gypsum panels unless blankets are readily installed after panels have been installed on one side.

3.3 APPLYING INTERIOR GYPSUM BOARD

A. Install interior gypsum board in the following locations:

1. Wallboard Type: As indicated on Drawings.
2. Type X: As indicated on Drawings.
3. Flexible Type: Apply in double layer at curved assemblies.
4. Ceiling Type: As indicated on Drawings.
5. Foil-Backed Type: As indicated on Drawings.
6. Abuse-Resistant Type: As indicated on Drawings.
7. Moisture- and Mold-Resistant Type: As indicated on Drawings.
8. Type X: Where required for specific fire-resistance-rated assembly indicated.
9. Glass-Mat Interior Type: As indicated on Drawings.
10. Skim-Coated Type: As indicated on Drawings.

B. Single-Layer Application:

1. On ceilings, apply gypsum panels before wall/partition board application to greatest extent possible and at right angles to framing unless otherwise indicated.
2. On partitions/walls, apply gypsum panels vertically (parallel to framing) unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints.

    a. Stagger abutting end joints not less than one framing member in alternate courses of panels.
    b. At stairwells and other high walls, install panels horizontally unless otherwise indicated or required by fire-resistance-rated assembly.

3. On Z-furring members, apply gypsum panels vertically (parallel to framing) with no end joints. Locate edge joints over furring members.
4. Fastening Methods: Apply gypsum panels to supports with steel drill screws.

C. Multilayer Application:

1. On ceilings, apply gypsum board indicated for base layers before applying base layers on walls/partitions; apply face layers in same sequence. Apply base layers at right angles to framing members and offset face-layer joints one framing member, 16 inches (400 mm) minimum, from parallel base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly.
2. On partitions/walls, apply gypsum board indicated for base layers and face layers vertically (parallel to framing) with joints of base layers located over stud or furring member and face-layer joints offset at least one stud or furring member with base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly. Stagger joints on opposite sides of partitions.
3. On Z-furring members, apply base layer vertically (parallel to framing) and face layer either vertically (parallel to framing) or horizontally (perpendicular to framing) with vertical joints offset at least one furring member. Locate edge joints of base layer over furring members.

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4. Fastening Methods: Fasten base layers and face layers separately to supports with screws.

D. Laminating to Substrate: Where gypsum panels are indicated as directly adhered to a substrate (other than studs, joists, furring members, or base layer of gypsum board), comply with gypsum board manufacturer's written recommendations and temporarily brace or fasten gypsum panels until fastening adhesive has set.

3.4 APPLYING TILE BACKING PANELS

A. Water-Resistant Backing Panels: Comply with manufacturer's written installation instructions and install at locations indicated to receive tile. Install with 1/4-inch (6.4-mm) gap where panels abut other construction or penetrations.

B. Cementitious Backer Units: ANSI A108.11, at wet areas, and where indicated.

C. Where tile backing panels abut other types of panels in same plane, shim surfaces to produce a uniform plane across panel surfaces.

3.5 INSTALLING TRIM ACCESSORIES

A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.

B. Control Joints: Install control joints according to ASTM C 840 and in specific locations approved by Architect for visual effect.

C. Interior Trim: Install in the following locations:

1. Corner bead: Use at outside corners.
2. Bullnose Bead: Use where indicated.
3. LC-Bead: Use at exposed panel edges.
4. L-Bead: Use where indicated.
5. U-Bead: Use at exposed panel edges.
6. Curved-Edge corner bead: Use at curved openings.

D. Exterior Trim: Install in the following locations:

1. Corner bead: Use at outside corners.
2. LC-Bead: Use at exposed panel edges.

E. Aluminum Trim: Install in locations indicated on Drawings.

3.6 FINISHING GYPSUM BOARD

A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.

B. Prefill open joints, rounded or beveled edges, and damaged surface areas.

C. Apply joint tape over gypsum board joints, except for trim products specifically indicated as not intended to receive tape.

D. Gypsum Board Finish Levels: Drywall finishing to be installed in accordance with Gypsum Association “Recommended Levels of Gypsum Board Finish, #GA-214-M-97” and ASTM C 840.

1. Level #0
   a. For use in areas of temporary construction
   b. No taping, finishing or accessories.
2. Level #1
   a. In areas above ceilings and areas not exposed to public view. Tape and fastener heads need not be covered with joint compound.
   b. Tape, set in joint compound at joints and interior angles.
   c. Finish surface to be free of excess compound. Some tool marks and ridges are acceptable.
3. Level #2
   a. Use at water-resistant backing board used as base for ceramic tile.
   b. At joints and interior angles: Embed tape in compound and wiped with joint knife leaving thin coat of compound over tape.
   c. At accessories and fasteners: Cover with one separate coat of joint compound.
   d. Finish surface to be free of excess compound. Tool marks and ridges are acceptable. Compound applied over tape at time of embedment is considered separate coat and satisfies the conditions of this level.
4. Level #3
   a. Use in areas to receive medium or heavy-duty textured coatings; or where heavy-duty wall coverings are to be applied.
   b. At joints and interior angles: Taped as "Level #2” then covered with one separate coat of joint compound.
   c. At accessories and fasteners: Cover with two separate coats of joint compound.
   d. Surface to be smooth and free of all ridges and tool marks.
5. Level #4
   a. Use in areas to receive flat paint, light texture finish, or light-duty wall covering.
   b. At joints: Taped as "Level #2” then covered with two separate coats of joint compound.
   c. At interior angles: Taped as "Level #2” then covered with one separate coat of joint compound.
   d. At accessories and fasteners: Cover with three separate coats of joint compound.
   e. Surface to be smooth and free of all ridges and tool marks.
6. Level #5: Where indicated on Drawings.
   a. Primer and its application to surfaces are specified in other Division 09 Sections.

E. Cementitious Backer Units: Finish according to manufacturer's written instructions.

3.7 PROTECTION

A. Protect adjacent surfaces from drywall compound and promptly remove from floors and other non-drywall surfaces. Repair surfaces stained, marred, or otherwise damaged during drywall application.

B. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.

C. Remove and replace panels that are wet, moisture damaged, and mold damaged.

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1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 09 29 00

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SECTION 093000 - TILING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Ceramic tile.
2. Stone thresholds.
3. Waterproof membrane.
4. Crack isolation membrane.
5. Tile backing panels.
6. Metal edge strips.

B. Related Sections:

1. Division 07 Section "[Self-Adhering Sheet Waterproofing] [Elastomeric Sheet Waterproofing] [Thermoplastic Sheet Waterproofing] [Hot Fluid-Applied Rubberized Asphalt Waterproofing]" [Cold Fluid-Applied Waterproofing] for waterproofing under thickset mortar beds.
2. Division 07 Section "Joint Sealants" for sealing of expansion, contraction, control, and isolation joints in tile surfaces.
3. Division 09 Section "Portland Cement Plastering" for portland cement scratch coat over metal lath on wall surfaces.
4. Division 09 Section "Gypsum Veneer Plastering" for cementitious backer units.
5. Division 09 Section "Gypsum Board" for [cementitious backer units] [glass-mat, water-resistant backer board].
6. Division 09 Section "Stone Tiling."
7. Division 09 Section "Stone Flooring" for stone thresholds.

1.3 DEFINITIONS

A. General: Definitions in the ANSI A108 series of tile installation standards and in ANSI A137.1 apply to Work of this Section unless otherwise specified.

B. ANSI A108 Series: ANSI A108.01, ANSI A108.02, ANSI A108.1A, ANSI A108.1B, ANSI A108.1C, ANSI A108.4, ANSI A108.5, ANSI A108.6, ANSI A108.8, ANSI A108.9, ANSI A108.10, ANSI A108.11, ANSI A108.12, ANSI A108.13, ANSI A108.14, ANSI A108.15, ANSI A108.16, and ANSI A108.17, which are contained in "American National Standard Specifications for Installation of Ceramic Tile."

C. Module Size: Actual tile size plus joint width indicated.

D. Face Size: Actual tile size, excluding spacer lugs.

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1.4 PERFORMANCE REQUIREMENTS

A. Static Coefficient of Friction: For tile installed on walkway surfaces, provide products with the following values as determined by testing identical products per ASTM C 1028:

1. Level Surfaces: Minimum <Insert required static coefficient of friction>.
2. Step Treads: Minimum <Insert required static coefficient of friction>.
3. Ramp Surfaces: Minimum <Insert required static coefficient of friction>.

1.5 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. Product Data for Credit IEQ 4.3: For [adhesives] [and] [grouts], documentation including printed statement of VOC content.
3. Product Data for Credit IEQ 4.3: For tile floors, documentation from an independent testing agency indicating compliance with the FloorScore Standard.
4. Laboratory Test Reports for Credit IEQ 4: For [adhesives] [sealants] [and] [tile flooring systems], 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."

C. Shop Drawings: Show locations of each type of tile and tile pattern. Show widths, details, and locations of expansion, contraction, control, and isolation joints in tile substrates and finished tile surfaces.

D. Samples for Initial Selection: For each type of tile and grout indicated. Include Samples of accessories involving color selection.

E. Samples for Verification:

1. Full-size units of each type and composition of tile and for each color and finish required.[For ceramic mosaic tile in color blend patterns, provide full sheets of each color blend.]
2. Assembled samples mounted on a rigid panel, with grouted joints, for each type and composition of tile and for each color and finish required. Make samples at least [12 inches (300 mm) square] <Insert size>, but not fewer than 4 tiles. Use grout of type and in color or colors approved for completed Work.
3. Full-size units of each type of trim and accessory[for each color and finish required].
4. Stone thresholds in 6-inch (150-mm) lengths.
5. Metal edge strips in 6-inch (150-mm) lengths.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer.

B. Master Grade Certificates: For each shipment, type, and composition of tile, signed by tile manufacturer and Installer.

C. Product Certificates: For each type of product, signed by product manufacturer.

D. Material Test Reports: For each tile-setting and -grouting product[and special purpose tile].

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match and are from same production runs as products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Tile and Trim Units:[Furnish quantity of full-size units equal to 3 percent of amount installed for each type, composition, color, pattern, and size indicated.]

a. <Insert, in separate subparagraphs, tile-type designation or description and quantity required for each category of tile for which extra material is required>.

2. Grout: Furnish quantity of grout equal to 3 percent of amount installed for each type, composition, and color indicated.

1.8 QUALITY ASSURANCE

A. Source Limitations for Tile: Obtain [tile of each type and color or finish] [tile of each type] [tile of each color or finish] [tile] from one source or producer.

1. Obtain tile of each type and color or finish from same production run and of consistent quality in appearance and physical properties for each contiguous area.

B. Source Limitations for Setting and Grouting Materials: Obtain ingredients of a uniform quality for each mortar, adhesive, and grout component from one manufacturer and each aggregate from one source or producer.

C. Source Limitations for Other Products: Obtain each of the following products specified in this Section from a single manufacturer for each product:

1. Stone thresholds.
2. Waterproof membrane.
3. Crack isolation membrane.
4. Joint sealants.
5. Cementitious backer units.
6. Metal edge strips.

D. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Build mockup of[each type of] floor tile installation.
2. Build mockup of[each type of] wall tile installation.
3. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

E. Preinstallation Conference: Conduct conference at [Project site] <Insert location>.

1. Review requirements in ANSI A108.01 for substrates and for preparation by other trades.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with requirements in ANSI A137.1 for labeling tile packages.

B. Store tile and cementitious materials on elevated platforms, under cover, and in a dry location.

C. Store aggregates where grading and other required characteristics can be maintained and contamination can be avoided.

D. Store liquid materials in unopened containers and protected from freezing.

E. Handle tile that has temporary protective coating on exposed surfaces to prevent coated surfaces from contacting backs or edges of other units. If coating does contact bonding surfaces of tile, remove coating from bonding surfaces before setting tile.

1.10 PROJECT CONDITIONS

A. Environmental Limitations: Do not install tile until construction in spaces is complete and ambient temperature and humidity conditions are maintained at the levels indicated in referenced standards and manufacturer's written instructions.

PART 2 - PRODUCTS

2.1 PRODUCTS, GENERAL

A. ANSI Ceramic Tile Standard: Provide tile that complies with ANSI A137.1 for types, compositions, and other characteristics indicated.

1. Provide tile complying with Standard grade requirements unless otherwise indicated.

B. ANSI Standards for Tile Installation Materials: Provide materials complying with ANSI A108.02, ANSI standards referenced in other Part 2 articles, ANSI standards referenced by TCA installation methods specified in tile installation schedules, and other requirements specified.

C. FloorScore Compliance: Tile for floors shall comply with requirements of FloorScore Standard.

D. Low-Emitting Materials: Tile flooring systems 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. Factory Blending: For tile exhibiting color variations within ranges, blend tile in factory and package so tile units taken from one package show same range in colors as those taken from other packages and match approved Samples.

F. Mounting: For factory-mounted tile, provide back- or edge-mounted tile assemblies as standard with manufacturer unless otherwise indicated.

1. Where tile is indicated for installation [in swimming pools] [on exteriors] [or] [in wet areas], do not use back- or edge-mounted tile assemblies unless tile manufacturer specifies in

writing that this type of mounting is suitable for installation indicated and has a record of successful in-service performance.

G. Factory-Applied Temporary Protective Coating: Where indicated under tile type, protect exposed surfaces of tile against adherence of mortar and grout by precoating with continuous film of petroleum paraffin wax, applied hot. Do not coat unexposed tile surfaces.

2.2 TILE PRODUCTS

A. Tile Type [CT-<#>]: Factory-mounted [unglazed] [glazed] ceramic mosaic tile.

1. Manufacturers: Subject to compliance with requirements, [provide products by one of the following] [available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
2. Basis-of-Design Product: Subject to compliance with requirements, provide [product indicated on Drawings] <Insert manufacturer's name; product name or designation> or comparable product by one of the following:

   a. American Olean; Division of Dal-Tile International Inc.
   b. Crossville, Inc.
   c. Daltile; Division of Dal-Tile International Inc.
   d. Deutsche Steinzeug America, Inc.
   e. Interceramic.
   f. Lone Star Ceramics Company.
   g. Grupo Porcelanite.
   h. Portobello America, Inc.
   i. Seneca Tiles, Inc.
   j. Or others as indicated on Finish Schedule.

3. Composition: [Porcelain] [Impervious natural clay or porcelain] [Vitreous or impervious natural clay or porcelain].
4. Module Size: [1 by 1 inch (25.4 by 25.4 mm)] [1 by 2 inches (25.4 by 50.8 mm)] [2 by 2 inches (50.8 by 50.8 mm)] <Insert size>.
5. Thickness: 1/4 inch (6.35 mm).
6. Face: [Plain] [Pattern of design indicated,] with cushion edges.
7. Surface: [Smooth, without] [Slip-resistant, with] abrasive admixture.
8. Finish: [Bright, opaque] [Bright, clear] [Mat, opaque] [Mat, clear] [Semimat, opaque] [Semimat, clear] [Vellum, opaque] [Vellum, clear] [Crystalline] <Insert description> glaze.
9. Tile Color and Pattern: [As indicated by manufacturer's designations] [Match Architect's sample] [As selected by Architect from manufacturer's full range] <Insert color and pattern>.
10. Grout Color: [As indicated by manufacturer's designations] [Match Architect's sample] [As selected by Architect from manufacturer's full range] <Insert color>.
11. Trim Units: Coordinated with sizes and coursing of adjoining flat tile where applicable[and matching characteristics of adjoining flat tile]. Provide shapes as follows, selected from manufacturer's standard shapes:

    a. Base Cove: Cove, module size [1 by 1 inch (25.4 by 25.4 mm)] [2 by 1 inch (50.8 by 25.4 mm)] <Insert size>.
    b. Base Cap for Portland Cement Mortar Installations: Bead (bullnose), module size [1 by 1 inch (25.4 by 25.4 mm)] [2 by 1 inch (50.8 by 25.4 mm)] <Insert size>.
    c. Base Cap for Thin-Set Mortar Installations: Surface bullnose, module size [1 by 1 inch (25.4 by 25.4 mm)] [2 by 1 inch (50.8 by 25.4 mm)] [2 by 2 inches (50.8 by 50.8 mm)] <Insert size>.

d. Wainscot Cap for Portland Cement Mortar Installations: Bead (bullnose), module size [1 by 1 inch (25.4 by 25.4 mm)] [2 by 1 inch (50.8 by 25.4 mm)] <Insert size>.
e. Wainscot Cap for Thin-Set Mortar Installations: Surface bullnose, module size [1 by 1 inch (25.4 by 25.4 mm)] [2 by 1 inch (50.8 by 25.4 mm)] [2 by 2 inches (50.8 by 50.8 mm)] <Insert size>.
f. Wainscot Cap for Flush Conditions: Regular flat tile for conditions where tile wainscot is shown flush with wall surface above it, same size as adjoining flat tile.
g. External Corners for Portland Cement Mortar Installations: Bead (bullnose), module size [1 by 1 inch (25.4 by 25.4 mm)] [2 by 1 inch (50.8 by 25.4 mm)] <Insert size>.
h. External Corners for Thin-Set Mortar Installations: Surface bullnose, module size [1 by 1 inch (25.4 by 25.4 mm)] [2 by 1 inch (50.8 by 25.4 mm)] [2 by 2 inches (50.8 by 50.8 mm)] <Insert size>.
i. Internal Corners: Cove, module size [1 by 1 inch (25.4 by 25.4 mm)] [2 by 1 inch (50.8 by 25.4 mm)] <Insert size>.
j. Internal Corners: Field-butted square corners. For coved base and cap, use angle pieces designed to fit with stretcher shapes.
k. Tapered Transition Tile: Shape designed to effect transition between thickness of tile floor and adjoining floor finishes of different thickness, tapered to provide reduction in thickness from 1/2 to 1/4 inch (12.7 to 6.35 mm) across nominal 4-inch (100-mm) dimension.

B. Tile Type [CT-<#>]: [Unglazed] [Glazed] square-edged quarry tile.

1. Manufacturers: Subject to compliance with requirements, [provide products by one of the following] [available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
2. Basis-of-Design Product: Subject to compliance with requirements, provide [product indicated on Drawings] <Insert manufacturer's name; product name or designation> or comparable product by one of the following:

a. American Olean; Division of Dal-Tile International Inc.
b. Atlas Minerals & Chemicals, Inc.
c. Daltile; Division of Dal-Tile International Inc.
d. Deutsche Steinzeug America, Inc.
e. Endicott Tile Ltd.; Endicott Clay Products Co.
f. Florida Brick & Clay Company Inc.
g. Florida Tile Industries, Inc.
h. Interceramic.
i. Metropolitan Ceramics.
j. Portobello America, Inc.
k. Quarry Tile Co.
l. Seneca Tiles, Inc.
m. Summitville Tiles, Inc.
n. United States Ceramic Tile Company.
o. Or others as indicated on Finish Schedule.

3. Face Size: [3 by 3 inches (76 by 76 mm)] [4 by 4 inches (102 by 102 mm)] [6 by 3 inches (152 by 76 mm)] [6 by 6 inches (152 by 152 mm)] [8 by 3-7/8 inches (203 by 98 mm)] [8 by 8 inches (203 by 203 mm)] <Insert size>.
4. Thickness: [3/8 inch (9.5 mm)] [1/2 inch (12.7 mm)] [3/4 inch (19 mm)].
5. Wearing Surface: [Nonabrasive, smooth] [Abrasive aggregate embedded in surface] <Insert description>.
6. Finish: [Bright, opaque] [Bright, clear] [Mat, opaque] [Mat, clear] [Semimat, opaque] [Semimat, clear] [Vellum, opaque] [Vellum, clear] [Crystalline] <Insert description> glaze.

7. Tile Color and Pattern: [As indicated by manufacturer's designations] [Match Architect's sample] [As selected by Architect from manufacturer's full range] <Insert color and pattern>.
8. Grout Color: [As indicated by manufacturer's designations] [Match Architect's sample] [As selected by Architect from manufacturer's full range] <Insert color>.
9. For furan-grouted quarry tile, precoat with temporary protective coating.
10. Trim Units: Coordinated with sizes and coursing of adjoining flat tile where applicable[and matching characteristics of adjoining flat tile]. Provide shapes as follows, selected from manufacturer's standard shapes:

    a. Base: Coved[with surface bullnose top edge], face size [6 by 6 inches (152 by 152 mm)] [8 by 3-7/8 inches (203 by 98 mm)] <Insert size>.
    b. Wainscot Cap: Surface bullnose, face size [6 by 6 inches (152 by 152 mm)] [8 by 3-7/8 inches (203 by 98 mm)] <Insert size>.
    c. Wainscot Cap for Flush Conditions: Regular flat tile for conditions where tile wainscot is shown flush with wall surface above it, same size as adjoining flat tile.

C. Tile Type [CT-<#>]: [Unglazed] [Glazed] paver tile.

1. Manufacturers: Subject to compliance with requirements, [provide products by one of the following] [available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
2. Basis-of-Design Product: Subject to compliance with requirements, provide [product indicated on Drawings] <Insert manufacturer's name; product name or designation> or comparable product by one of the following:

    a. American Marazzi Tile, Inc.
    b. American Olean; Division of Dal-Tile International Inc.
    c. Crossville, Inc.
    d. Daltile; Division of Dal-Tile International Inc.
    e. Deutsche Steinzeug America, Inc.
    f. Florida Tile Industries, Inc.
    g. Florim USA.
    h. GranitiFiandre; c/o Trans Ceramica, Ltd.
    i. Interceramic.
    j. Laufen.
    k. Lone Star Ceramics Company.
    l. Grupo Porcelanite.
    m. Portobello America, Inc.
    n. Seneca Tiles, Inc.
    o. United States Ceramic Tile Company.
    p. Or others as indicated on Finish Schedule.

3. Composition: [Porcelain] [Impervious natural clay or porcelain] [Vitreous or impervious natural clay or porcelain] [Natural clay or porcelain].
4. Face Size: [3 by 3 inches (76 by 76 mm)] [4 by 4 inches (102 by 102 mm)] [6 by 6 inches (152 by 152 mm)] [7-3/4 by 3-7/8 inches (197 by 98 mm)] [7-7/8 by 7-7/8 inches (200 by 200 mm)] [11-13/16 by 11-13/16 inches (300 by 300 mm)] [165 by 333 mm] [200 by 250 mm] [250 by 250 mm] [165 by 333 mm] [333 by 333 mm] [400 by 400 mm] <Insert size>.
5. Thickness: [1/4 inch (6.35 mm)] [3/8 inch (9.5 mm)] [1/2 inch (12.7 mm)].
6. Face: [Plain with square or cushion edges] [Plain with square edges] [Plain with cushion edges] [Pattern of design indicated, with square or cushion edges] [As indicated].
7. Finish: [Bright, opaque] [Bright, clear] [Mat, opaque] [Mat, clear] [Semimat, opaque] [Semimat, clear] [Vellum, opaque] [Vellum, clear] [Crystalline] <Insert description> glaze.

8. Tile Color and Pattern: [As indicated by manufacturer's designations] [Match Architect's sample] [As selected by Architect from manufacturer's full range] <Insert color and pattern>.
9. Grout Color: [As indicated by manufacturer's designations] [Match Architect's sample] [As selected by Architect from manufacturer's full range] <Insert color>.
10. Trim Units: Coordinated with sizes and coursing of adjoining flat tile where applicable[and matching characteristics of adjoining flat tile]. Provide shapes as follows, selected from manufacturer's standard shapes:

    a. Base Cove: Cove, module size [same as adjoining flat tile] <Insert size>.
    b. Base Cap for Portland Cement Mortar Installations: Bead (bullnose), module size [same as adjoining flat tile] <Insert size>.
    c. Base Cap for Thin-Set Mortar Installations: Surface bullnose, module size [same as adjoining flat tile] <Insert size>.
    d. Wainscot Cap for Portland Cement Mortar Installations: Bead (bullnose), module size [same as adjoining flat tile] <Insert size>.
    e. Wainscot Cap for Thin-Set Mortar Installations: Surface bullnose, module size [same as adjoining flat tile] <Insert size>.
    f. Wainscot Cap for Flush Conditions: Regular flat tile for conditions where tile wainscot is shown flush with wall surface above it, same size as adjoining flat tile.
    g. External Corners for Portland Cement Mortar Installations: Bead (bullnose), module size [same as adjoining flat tile] <Insert size>.
    h. External Corners for Thin-Set Mortar Installations: Surface bullnose, module size [same as adjoining flat tile] <Insert size>.
    i. Internal Corners: Cove, module size [same as adjoining flat tile] <Insert size>.
    j. Internal Corners: Field-butted square corners. For coved base and cap, use angle pieces designed to fit with stretcher shapes.
    k. Tapered Transition Tile: Shape designed to effect transition between thickness of tile floor and adjoining floor finishes of different thickness, tapered to provide reduction in thickness from 1/2 to 1/4 inch (12.7 to 6.35 mm) across nominal 4-inch (100-mm) dimension.

D. Tile Type [CT-<#>]: [Glazed wall tile] [Decorative thin wall tile].

1. Manufacturers: Subject to compliance with requirements, [provide products by one of the following] [available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
2. Basis-of-Design Product: Subject to compliance with requirements, provide [product indicated on Drawings] <Insert manufacturer's name; product name or designation> or comparable product by one of the following:

    a. American Marazzi Tile, Inc.
    b. American Olean; Division of Dal-Tile International Inc.
    c. Daltile; Division of Dal-Tile International Inc.
    d. Deutsche Steinzeug America, Inc.
    e. Florida Tile Industries, Inc.
    f. Florim USA.
    g. Laufen.
    h. Grupo Porcelanite.
    i. Portobello America, Inc.
    j. Seneca Tiles, Inc.
    k. United States Ceramic Tile Company.
    l. <Insert manufacturer's name>.

3. Module Size: [4-1/4 by 4-1/4 inches (108 by 108 mm)] [6 by 4-1/4 inches (152 by 108 mm)] [6 by 6 inches (152 by 152 mm)] [200 by 200 mm] [250 by 250 mm] [200 by 300 mm] <Insert size>.
4. Thickness: 5/16 inch (8 mm).
5. Face: [Plain with modified square edges or cushion edges] [Plain with modified square edges] [Plain with cushion edges] [Pattern of design indicated, with manufacturer's standard edges].
6. Finish: [Bright, opaque] [Bright, clear] [Mat, opaque] [Mat, clear] [Semimat, opaque] [Semimat, clear] [Vellum, opaque] [Vellum, clear] [Crystalline] <Insert description> glaze.
7. Tile Color and Pattern: [As indicated by manufacturer's designations] [Match Architect's sample] [As selected by Architect from manufacturer's full range] <Insert color and pattern>.
8. Grout Color: [As indicated by manufacturer's designations] [Match Architect's sample] [As selected by Architect from manufacturer's full range] <Insert color>.
9. Mounting: Factory, back mounted.
10. Mounting: Pregrouted sheets of tiles factory assembled and grouted with manufacturer's standard white silicone rubber.
11. Trim Units: Coordinated with sizes and coursing of adjoining flat tile where applicable[and matching characteristics of adjoining flat tile]. Provide shapes as follows, selected from manufacturer's standard shapes:

    a. Base for Portland Cement Mortar Installations: Coved, module size [4-1/4 by 4-1/4 inches (108 by 108 mm)] [6 by 6 inches (152 by 152 mm)] [6 by 3-3/4 inches (152 by 95 mm)] <Insert size>.
    b. Base for Thin-Set Mortar Installations: Straight, module size [4-1/4 by 4-1/4 inches (108 by 108 mm)] [6 by 6 inches (152 by 152 mm)] [6 by 2 inches (152 by 51 mm)] <Insert size>.
    c. Wainscot Cap for Portland Cement Mortar Installations: Bullnose cap, module size [4-1/4 by 4-1/4 inches (108 by 108 mm)] [6 by 6 inches (152 by 152 mm)] [6 by 2 inches (152 by 51 mm)] <Insert size>.
    d. Wainscot Cap for Thin-Set Mortar Installations: Surface bullnose, module size [4-1/4 by 4-1/4 inches (108 by 108 mm)] [6 by 6 inches (152 by 152 mm)] [6 by 2 inches (152 by 51 mm)] <Insert size>.
    e. Wainscot Cap for Flush Conditions: Regular flat tile for conditions where tile wainscot is shown flush with wall surface above it, same size as adjoining flat tile.
    f. External Corners for Portland Cement Mortar Installations: Bullnose shape with radius of at least 3/4 inch (19 mm) unless otherwise indicated.
    g. External Corners for Thin-Set Mortar Installations: Surface bullnose, same size as adjoining flat tile.
    h. Internal Corners: Field-butted square corners. For coved base and cap use angle pieces designed to fit with stretcher shapes.

E. Accessories: Provide vitreous china accessories of type and size indicated, suitable for installing by same method as adjoining wall tile.

1. One soap holder[with grab handle] for each shower and tub indicated.
2. One paper holder at each water closet.
3. Color and Finish: [Match adjoining glazed wall tile] [As indicated by manufacturer's designations] [Match Architect's sample] [As selected by Architect from manufacturer's full range] [White, bright glaze] <Insert color and finish>.

2.3 THRESHOLDS

A. General: Fabricate to sizes and profiles indicated or required to provide transition between adjacent floor finishes.

1. Bevel edges at 1:2 slope, with lower edge of bevel aligned with or up to 1/16 inch (1.5 mm) above adjacent floor surface. Finish bevel to match top surface of threshold. Limit height of threshold to 1/2 inch (12.7 mm) or less above adjacent floor surface.

B. Granite Thresholds: ASTM C 615, with [polished] [honed] <Insert finish> finish.

1. Description: Uniform, [fine] [medium]-grained, [white] [gray] [black] <Insert color> stone without veining.
2. Description: Match Architect's sample.
3. Description: Provide[one of] the following:

a. <Insert, in separate subparagraphs, name of variety and producer, distributor, or importer>.

C. Marble Thresholds: ASTM C 503, with a minimum abrasion resistance of [10] [12] per ASTM C 1353 or ASTM C 241 and with honed finish.

1. Description: Uniform, fine- to medium-grained white stone with gray veining.
2. Description: Match Architect's sample.
3. Description: Provide[one of] the following:

a. <Insert, in separate subparagraphs, name of variety and producer, distributor, or importer>.

D. Slate Thresholds: ASTM C 629, Classification [I Exterior] [II Interior], with fine, even grain and honed finish.

1. Description: Uniform, [black] [blue-black] [gray] [blue-gray] [green] <Insert color> stone[and unfading].
2. Description: Match Architect's sample.
3. Description: Provide[one of] the following:

a. <Insert, in separate subparagraphs, name of variety and producer, distributor, or importer>.

2.4 TILE BACKING PANELS

A. Cementitious Backer Units: ANSI A118.9 or ASTM C 1325, in maximum lengths available to minimize end-to-end butt joints.

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

a. C-Cure; C-Cure Board 990.
b. Custom Building Products; Wonderboard.
c. FinPan, Inc.; Util-A-Crete Concrete Backer Board.
d. USG Corporation; DUROCK Cement Board.

2. Thickness: [1/4 inch (6.4 mm)] [1/2 inch (12.7 mm)] [5/8 inch (15.9 mm)] [As indicated].

B. Fiber-Cement Underlayment: ASTM C 1288, in maximum lengths available to minimize end-to-end butt joints.

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

   a. CertainTeed Corp.; FiberCement [Underlayment] [BackerBoard].
   b. James Hardie; [Hardiebacker] [Hardiebacker 500].

2. Thickness: [1/4 inch (6.4 mm)] [1/2 inch (12.7 mm)] [As indicated].

2.5 WATERPROOF MEMBRANE

A. General: Manufacturer's standard product[, selected from the following,] that complies with ANSI A118.10 and is recommended by the manufacturer for the application indicated. Include reinforcement and accessories recommended by manufacturer.

B. Chlorinated Polyethylene Sheet: Nonplasticized, chlorinated polyethylene faced on both sides with nonwoven polyester fabric; 0.030-inch (0.76-mm) nominal thickness.

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

   a. Noble Company (The); Nobleseal TS.
   b. <Insert manufacturer's name; product name or designation>.

C. PVC Sheet: Two layers of PVC sheet heat-fused together and to facings of nonwoven polyester; 0.040-inch (1.01-mm) nominal thickness.

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

   a. Compotite Corporation; Composeal Gold.
   b. <Insert manufacturer's name; product name or designation>.

D. Polyethylene Sheet: Polyethylene faced on both sides with fleece webbing; 0.008-inch (0.203-mm) nominal thickness.

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

   a. Schluter Systems L.P.; KERDI.
   b. <Insert manufacturer's name; product name or designation>.

E. Fabric-Reinforced, Modified-Bituminous Sheet: Self-adhering, SBS-modified-bituminous sheet with woven reinforcement facing; 0.040-inch (1.01-mm) nominal thickness.

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

   a. National Applied Construction Products, Inc.; Strataflex.
   b. <Insert manufacturer's name; product name or designation>.

F. Fabric-Reinforced, Fluid-Applied Membrane: System consisting of liquid-latex rubber or elastomeric polymer and continuous fabric reinforcement.

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

a. Boiardi Products; a QEP company; Elastiment 344 Reinforced Waterproofing and Anti-Fracture/Crack Suppression Membrane.
b. Bonsal American; an Oldcastle company; B 6000 Waterproof Membrane with Glass Fabric.
c. Bostik, Inc.; Hydroment Blacktop 90210.
d. Custom Building Products; 9240 Waterproofing and Anti-Fracture Membrane.
e. Laticrete International, Inc.; Laticrete 9235 Waterproof Membrane.
f. MAPEI Corporation; [Mapelastic L (PRP M19)] [Mapelastic HPG with MAPEI Fiberglass Mesh].
g. Mer-Kote Products, Inc.; Hydro-Guard 2000.
h. Summitville Tiles, Inc.; S-9000.
i. <Insert manufacturer's name; product name or designation>.

G. Fluid-Applied Membrane: Liquid-latex rubber or elastomeric polymer.

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

a. Boiardi Products; a QEP company; Elastiment 644 Membrane Waterproofing System.
b. Bonsal American; an Oldcastle company; B 6000 Waterproof Membrane.
c. Bostik, Inc.; [Durabond D-222 Duraguard Membrane] [Hydroment Gold].
d. C-Cure; Pro-Red Waterproofing Membrane 63.
e. Custom Building Products; Redgard Waterproofing and Crack Prevention Membrane.
f. Jamo Inc.; Waterproof.
g. Laticrete International, Inc.; [Latapoxy 24hr HydroProofing] [Laticrete Watertight Floor N' Wall Waterproofing].
h. MAPEI Corporation; Mapelastic HPG.
i. Southern Grouts & Mortars, Inc.; Southcrete 1100 Crack Suppression and Waterproofing.
j. TEC; a subsidiary of H. B. Fuller Company; HydraFlex - Waterproofing Crack Isolation Membrane.
k. <Insert manufacturer's name; product name or designation>.

H. Latex-Portland Cement: Flexible mortar consisting of cement-based mix and latex additive.

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

a. Boiardi Products; a QEP company; Elastiment 323 Cement Based Waterproofing, Anti-Fracture/Crack Suppression Membrane.
b. C-Cure; UltraCure 971.
c. MAPEI Corporation; Mapelastic (PRP 315).
d. Southern Grouts & Mortars, Inc.; Southcrete 1100.
e. TEC; a subsidiary of H. B. Fuller Company; Triple Flex Waterproofing, Crack Isolation Membrane & Mortar.

f. <Insert manufacturer's name; product name or designation>.

I. Urethane Waterproofing and Tile-Setting Adhesive: One-part, liquid-applied urethane[, with a VOC content of 65 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24),][, that complies 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,"] in a consistency suitable for trowel application and intended for use as both waterproofing and tile-setting adhesive in a two-step process.

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

a. Bostik, Inc.; [Durabond D-200] [Hydroment Ultra-Set] [Hydroment Ultra-Set Advanced].
b. <Insert manufacturer's name; product name or designation>.

2.6 CRACK ISOLATION MEMBRANE

A. General: Manufacturer's standard product[, selected from the following,] that complies with ANSI A118.12 for [standard] [high] performance and is recommended by the manufacturer for the application indicated. Include reinforcement and accessories recommended by manufacturer.

B. Chlorinated Polyethylene Sheet: Nonplasticized, chlorinated polyethylene faced on both sides with nonwoven polyester fabric; 0.030-inch (0.76-mm) nominal thickness.

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

a. Noble Company (The); Nobleseal CIS.
b. <Insert manufacturer's name; product name or designation>.

C. PVC Sheet: Two layers of PVC sheet heat-fused together and to facings of nonwoven polyester; 0.040-inch (1.01-mm) nominal thickness.

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

a. Compotite Corporation; Composeal Gold.
b. <Insert manufacturer's name; product name or designation>.

D. Polyethylene Sheet: Polyethylene faced on both sides with fleece webbing; 0.008-inch (0.203-mm) nominal thickness.

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

a. Schluter Systems L.P.; KERDI.
b. <Insert manufacturer's name; product name or designation>.

E. Corrugated Polyethylene: Corrugated polyethylene with dovetail-shaped corrugations and with anchoring webbing on the underside; 3/16-inch (4-mm) nominal thickness.

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

a. Schluter Systems L.P.; DITRA.
b. <Insert manufacturer's name; product name or designation>.

F. Fabric-Reinforced, Modified-Bituminous Sheet: Self-adhering, modified-bituminous sheet with fabric reinforcement facing; 0.040-inch (1.01-mm) nominal thickness.

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

a. MAPEI Corporation; Mapelastic SM.
b. National Applied Construction Products, Inc.; Strataflex.
c. <Insert manufacturer's name; product name or designation>.

G. Fabric-Reinforced, Fluid-Applied Membrane: System consisting of liquid-latex rubber or elastomeric polymer and fabric reinforcement.

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

a. Boiardi Products; a QEP company; Elastiment 344 Reinforced Waterproofing and Anti-Fracture/Crack Suppression Membrane.
b. Bonsal American; an Oldcastle company; B 6000 Waterproof Membrane with Glass Fabric.
c. Bostik, Inc.; Hydroment Blacktop 90210.
d. Custom Building Products; 9240 Waterproofing and Anti-Fracture Membrane.
e. Laticrete International, Inc.; Laticrete [Blue 92 Anti-Fracture Membrane] [9235 Waterproof Membrane].
f. MAPEI Corporation; [Mapelastic L (PRP M19)] [Mapelastic HPG with MAPEI Fiberglass Mesh].
g. Mer-Kote Products, Inc.; Hydro-Guard 2000.
h. Summitville Tiles, Inc.; S-9000.

H. Fluid-Applied Membrane: Liquid-latex rubber or elastomeric polymer.

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

a. Bostik, Inc.; [Durabond D-222 Duraguard Membrane] [Hydroment Gold].
b. C-Cure; [CureLastic 949] [Pro-Red Waterproofing Membrane 963].
c. Custom Building Products; [Redgard Waterproofing and Crack Prevention Membrane] [FractureFree Crack Prevention Membrane] [Semco Crack Prevention Membrane].
d. Jamo Inc.; Waterproof.
e. Mer-Kote Products, Inc.; Fracture-Guard 5000.

f. Southern Grouts & Mortars, Inc.; Southcrete 1100 Crack Suppression and Waterproofing.
g. TEC; a subsidiary of H. B. Fuller Company; HydraFlex - Waterproofing Crack Isolation Membrane.
h. <Insert manufacturer's name; product name or designation>.

I. Latex-Portland Cement: Flexible mortar consisting of cement-based mix and latex additive.

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

a. C-Cure; UltraCure 971.
b. MAPEI Corporation; Mapelastic (PRP 315).
c. TEC; a subsidiary of H. B. Fuller Company; Triple Flex Waterproofing, Crack Isolation Membrane & Mortar.
d. <Insert manufacturer's name; product name or designation>.

J. Urethane Crack Isolation Membrane and Tile-Setting Adhesive: One-part, liquid-applied urethane[, with a VOC content of 65 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24),][, that complies 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,"] in a consistency suitable for trowel application and intended for use as both waterproofing and tile-setting adhesive in a two-step process.

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

a. Bostik, Inc.; [Durabond D-200] [Hydroment Ultra-Set] [Hydroment Ultra-Set Advanced].
b. <Insert manufacturer's name; product name or designation>.

2.7 SETTING MATERIALS

A. Portland Cement Mortar (Thickset) Installation Materials: ANSI A108.02.

1. Cleavage Membrane: Asphalt felt, ASTM D 226, Type I (No. 15); or polyethylene sheeting, ASTM D 4397, 4.0 mils (0.1 mm) thick.
2. Reinforcing Wire Fabric: Galvanized, welded wire fabric, 2 by 2 inches (50.8 by 50.8 mm) by 0.062-inch (1.57-mm) diameter; comply with ASTM A 185 and ASTM A 82 except for minimum wire size.
3. Expanded Metal Lath: Diamond-mesh lath complying with ASTM C 847.

a. Base Metal and Finish for Interior Applications: Uncoated or zinc-coated (galvanized) steel sheet, with uncoated steel sheet painted after fabrication into lath.
b. Base Metal and Finish for Exterior Applications: Zinc-coated (galvanized) steel sheet.
c. Configuration over Studs and Furring: Flat.
d. Configuration over Solid Surfaces: Self furring.
e. Weight: [2.5 lb/sq. yd. (1.4 kg/sq. m)] [3.4 lb/sq. yd. (1.8 kg/sq. m)].

4. Latex Additive: [Manufacturer's standard] [acrylic resin] [or] [styrene-butadiene-rubber] water emulsion, serving as replacement for part or all of gaging water, of type specifically recommended by latex-additive manufacturer for use with field-mixed portland cement and aggregate mortar bed.

B. Dry-Set Portland Cement Mortar (Thin Set): ANSI A118.1.

1. Manufacturers: Subject to compliance with requirements, [provide products by one of the following] [available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
2. Basis-of-Design Product: Subject to compliance with requirements, provide [product indicated on Drawings] <Insert manufacturer's name; product name or designation> or comparable product by one of the following:

a. Boiardi Products; a QEP company.
b. Bonsal American; an Oldcastle company.
c. Bostik, Inc.
d. C-Cure.
e. Custom Building Products.
f. Jamo Inc.
g. Laticrete International, Inc.
h. MAPEI Corporation.
i. Southern Grouts & Mortars, Inc.
j. Summitville Tiles, Inc.
k. TEC; a subsidiary of H. B. Fuller Company.

3. For wall applications, provide mortar that complies with requirements for nonsagging mortar in addition to the other requirements in ANSI A118.1.

C. Latex-Portland Cement Mortar (Thin Set): ANSI A118.4.

1. Manufacturers: Subject to compliance with requirements, [provide products by one of the following] [available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
2. Basis-of-Design Product: Subject to compliance with requirements, provide [product indicated on Drawings] <Insert manufacturer's name; product name or designation> or comparable product by one of the following:

a. Boiardi Products; a QEP company.
b. Bonsal American; an Oldcastle company.
c. Bostik, Inc.
d. C-Cure.
e. Custom Building Products.
f. Jamo Inc.
g. Laticrete International, Inc.
h. MAPEI Corporation.
i. Mer-Kote Products, Inc.
j. Southern Grouts & Mortars, Inc.
k. Summitville Tiles, Inc.
l. TEC; a subsidiary of H. B. Fuller Company.

3. Provide prepackaged, dry-mortar mix containing dry, redispersible, vinyl acetate or acrylic additive to which only water must be added at Project site.
4. Provide prepackaged, dry-mortar mix combined with [acrylic resin] [or] [styrene-butadiene-rubber] liquid-latex additive at Project site.

5. For wall applications, provide mortar that complies with requirements for nonsagging mortar in addition to the other requirements in ANSI A118.4.

D. Medium-Bed, Latex-Portland Cement Mortar: Comply with requirements in ANSI A118.4. Provide product that is approved by manufacturer for application thickness of [5/8 inch (16 mm)] <Insert thickness>.

1. Manufacturers: Subject to compliance with requirements, [provide products by one of the following] [available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
2. Basis-of-Design Product: Subject to compliance with requirements, provide [product indicated on Drawings] <Insert manufacturer's name; product name or designation> or comparable product by one of the following:

a. Bonsal American; an Oldcastle company.
b. Bostik, Inc.
c. C-Cure.
d. Custom Building Products.
e. Jamo Inc.
f. Laticrete International, Inc.
g. MAPEI Corporation.
h. Mer-Kote Products, Inc.
i. Southern Grouts & Mortars, Inc.
j. Summitville Tiles, Inc.
k. TEC; a subsidiary of H. B. Fuller Company.

3. Provide prepackaged, dry-mortar mix containing dry, redispersible, vinyl acetate or acrylic additive to which only water must be added at Project site.
4. Provide prepackaged, dry-mortar mix combined with [acrylic resin] [or] [styrene-butadiene-rubber] liquid-latex additive at Project site.

E. EGP (Exterior Glue Plywood) Latex-Portland Cement Mortar (Thin Set): ANSI A118.11.

1. Manufacturers: Subject to compliance with requirements, [provide products by one of the following] [available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
2. Basis-of-Design Product: Subject to compliance with requirements, provide [product indicated on Drawings] <Insert manufacturer's name; product name or designation> or comparable product by one of the following:

a. Bonsal American; an Oldcastle company.
b. Bostik, Inc.
c. C-Cure.
d. Custom Building Products.
e. Jamo Inc.
f. Laticrete International, Inc.
g. MAPEI Corporation.
h. Southern Grouts & Mortars, Inc.
i. Summitville Tiles, Inc.
j. TEC; a subsidiary of H. B. Fuller Company.

3. Provide prepackaged, dry-mortar mix containing dry, redispersible, vinyl acetate or acrylic additive to which only water must be added at Project site.
4. Provide prepackaged, dry-mortar mix combined with [acrylic resin] [or] [styrene-butadiene-rubber] liquid-latex additive at Project site.

F. Water-Cleanable, Tile-Setting Epoxy: ANSI A118.3[.][, with a VOC content of 65 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).][, that complies 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. Manufacturers: Subject to compliance with requirements, [provide products by one of the following] [available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
2. Basis-of-Design Product: Subject to compliance with requirements, provide [product indicated on Drawings] <Insert manufacturer's name; product name or designation> or comparable product by one of the following:

a. Atlas Minerals & Chemicals, Inc.
b. Bonsal American; an Oldcastle company.
c. Bostik, Inc.
d. C-Cure.
e. Custom Building Products.
f. Jamo Inc.
g. Laticrete International, Inc.
h. MAPEI Corporation.
i. Mer-Kote Products, Inc.
j. Southern Grouts & Mortars, Inc.
k. Summitville Tiles, Inc.
l. TEC; a subsidiary of H. B. Fuller Company.

3. Provide product capable of withstanding continuous and intermittent exposure to temperatures of up to 140 deg F (60 deg C) and 212 deg F (100 deg C), respectively, and certified by manufacturer for intended use.

G. Chemical-Resistant Furan Mortar: ANSI A118.5, with [carbon] <Insert material> filler.

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

a. Atlas Minerals & Chemicals, Inc.
b. <Insert manufacturer's name>.

H. Organic Adhesive: ANSI A136.1, Type I[.][, with a VOC content of 65 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).][, that complies 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. Manufacturers: Subject to compliance with requirements, [provide products by one of the following] [available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
2. Basis-of-Design Product: Subject to compliance with requirements, provide [product indicated on Drawings] <Insert manufacturer's name; product name or designation> or comparable product by one of the following:

a. Bonsal American; an Oldcastle company.
b. Bostik, Inc.
c. C-Cure.

d. Custom Building Products.
e. DAP Inc.
f. Jamo Inc.
g. Laticrete International, Inc.
h. MAPEI Corporation.
i. Southern Grouts & Mortars, Inc.
j. Summitville Tiles, Inc.
k. TEC; a subsidiary of H. B. Fuller Company.

2.8 GROUT MATERIALS

A. Sand-Portland Cement Grout: ANSI A108.10, composed of white or gray cement and white or colored aggregate as required to produce color indicated.

B. Standard Cement Grout: ANSI A118.6.

1. Manufacturers: Subject to compliance with requirements, [provide products by one of the following] [available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
2. Basis-of-Design Product: Subject to compliance with requirements, provide [product indicated on Drawings] <Insert manufacturer's name; product name or designation> or comparable product by one of the following:

a. Boiardi Products; a QEP company.
b. Bonsal American; an Oldcastle company.
c. Bostik, Inc.
d. C-Cure.
e. Custom Building Products.
f. Jamo Inc.
g. Laticrete International, Inc.
h. MAPEI Corporation.
i. Southern Grouts & Mortars, Inc.
j. Summitville Tiles, Inc.
k. TEC; a subsidiary of H. B. Fuller Company.

C. Polymer-Modified Tile Grout: ANSI A118.7.

1. Manufacturers: Subject to compliance with requirements, [provide products by one of the following] [available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
2. Basis-of-Design Product: Subject to compliance with requirements, provide [product indicated on Drawings] <Insert manufacturer's name; product name or designation> or comparable product by one of the following:

a. Boiardi Products; a QEP company.
b. Bonsal American; an Oldcastle company.
c. Bostik, Inc.
d. C-Cure.
e. Custom Building Products.
f. Jamo Inc.
g. Laticrete International, Inc.
h. MAPEI Corporation.
i. Southern Grouts & Mortars, Inc.
j. Summitville Tiles, Inc.

k. TEC; a subsidiary of H. B. Fuller Company.
l. <Insert manufacturer's name>.

3. Polymer Type: Ethylene vinyl acetate or acrylic additive, in dry, redispersible form, prepackaged with other dry ingredients.
4. Polymer Type: [Acrylic resin] [or] [styrene-butadiene rubber] in liquid-latex form for addition to prepackaged dry-grout mix.

D. Water-Cleanable Epoxy Grout: ANSI A118.3[, with a VOC content of 65 g/L or less when calculated according to 40 CFR 59, Subpart D].

1. Manufacturers: Subject to compliance with requirements, [provide products by one of the following] [available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
2. Basis-of-Design Product: Subject to compliance with requirements, provide [product indicated on Drawings] <Insert manufacturer's name; product name or designation> or comparable product by one of the following:

a. Atlas Minerals & Chemicals, Inc.
b. Boiardi Products; a QEP company.
c. Bonsal American; an Oldcastle company.
d. Bostik, Inc.
e. C-Cure.
f. Custom Building Products.
g. Jamo Inc.
h. Laticrete International, Inc.
i. MAPEI Corporation.
j. Mer-Kote Products, Inc.
k. Southern Grouts & Mortars, Inc.
l. Summitville Tiles, Inc.
m. TEC; a subsidiary of H. B. Fuller Company.

3. Provide product capable of withstanding continuous and intermittent exposure to temperatures of up to 140 deg F (60 deg C) and 212 deg F (100 deg C), respectively, and certified by manufacturer for intended use.

E. Chemical-Resistant Furan Grout: ANSI A118.5, with carbon filler[, with a VOC content of 65 g/L or less when calculated according to 40 CFR 59, Subpart D].

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

a. Atlas Minerals & Chemicals, Inc.
b. <Insert manufacturer's name>.

F. Grout for Pregrouted Tile Sheets: Same product used in factory to pregrout tile sheets.

2.9 ELASTOMERIC SEALANTS

A. General: Provide sealants, primers, backer rods, and other sealant accessories that comply with the following requirements and with the applicable requirements in Division 07 Section "Joint Sealants."

1. Sealants shall have a VOC content of [250] <Insert value> g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. 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."
3. Use primers, backer rods, and sealant accessories recommended by sealant manufacturer.

B. Colors: Provide colors of exposed sealants to match colors of grout in tile adjoining sealed joints unless otherwise indicated.

C. One-Part, Mildew-Resistant Silicone Sealant: ASTM C 920; Type S; Grade NS; Class 25; Uses NT, G, A, and, as applicable to nonporous joint substrates indicated, O; formulated with fungicide, intended for sealing interior ceramic tile joints and other nonporous substrates that are subject to in-service exposures of high humidity and extreme temperatures.

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

a. DAP Inc.; [Titanium Enriched Kitchen and Bath Sealant] [100 percent Silicone Kitchen and Bath Sealant].
b. Dow Corning Corporation; Dow Corning 786.
c. GE Silicones; a division of GE Specialty Materials; Sanitary 1700.
d. Laticrete International, Inc.; Latasil Tile & Stone Sealant.
e. Pecora Corporation; Pecora 898 Sanitary Silicone Sealant.
f. Tremco Incorporated; Tremsil 600 White.

D. Multipart, Pourable Urethane Sealant for Use T: ASTM C 920; Type M; Grade P; Class 25; Uses T, M, A, and, as applicable to joint substrates indicated, O.

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

a. Bostik, Inc.; Chem-Calk 550.
b. Degussa Building Systems; Sonneborn Sonolastic SL 2.
c. Pecora Corporation; [Dynatrol II-SG] [NR-200 Urexpan].
d. Sika Corporation; Sikaflex-2c SL.
e. Tremco Incorporated.; [THC-900] [THC-901] [Vulkem 245].

E. Chemical-Resistant Sealants: For chemical-resistant floors, provide chemical-resistant elastomeric sealant of type recommended and produced by chemical-resistant mortar and grout manufacturer for type of application indicated, with proven service record and compatibility with tile and other setting materials, and with chemical resistance equivalent to mortar/grout.

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

a. Atlas Minerals & Chemicals, Inc.

2.10 MISCELLANEOUS MATERIALS

A. Trowelable Underlayments and Patching Compounds: Latex-modified, portland cement-based formulation provided or approved by manufacturer of tile-setting materials for installations indicated.

B. Metal Edge Strips: Angle or L-shape, height to match tile and setting-bed thickness, metallic or combination of metal and PVC or neoprene base, designed specifically for flooring applications; [half-hard brass] [white zinc alloy] [nickel silver] [stainless-steel, ASTM A 666, 300 Series] exposed-edge material.

C. Temporary Protective Coating: [Either product] [Product] indicated below that is formulated to protect exposed surfaces of tile against adherence of mortar and grout; compatible with tile, mortar, and grout products; and easily removable after grouting is completed without damaging grout or tile.

1. Petroleum paraffin wax, fully refined and odorless, containing at least 0.5 percent oil with a melting point of 120 to 140 deg F (49 to 60 deg C) per ASTM D 87.
2. Grout release in form of manufacturer's standard proprietary liquid coating that is specially formulated and recommended for use as temporary protective coating for tile.

D. Tile Cleaner: A neutral cleaner capable of removing soil and residue without harming tile and grout surfaces, specifically approved for materials and installations indicated by tile and grout manufacturers.

E. Grout Sealer: Manufacturer's standard[silicone] product for sealing grout joints and that does not change color or appearance of grout.

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

a. Bonsal American; an Oldcastle company; Grout Sealer.
b. Bostik, Inc.; CeramaSeal [Grout & Tile Sealer] [Magic Seal] [Silox 8] [Siloxane 220].
c. C-Cure; Penetrating Sealer 978.
d. Custom Building Products; [Surfaceguard] [Grout and Tile] [Grout] Sealer.
e. Jamo Inc.; [Matte Finish] [Penetrating] Sealer.
f. MAPEI Corporation; KER [003, Silicone Spray Sealer for Cementitious Tile Grout] [004, Keraseal Penetrating Sealer for Unglazed Grout and Tile].
g. Southern Grouts & Mortars, Inc.; Silicone Grout Sealer.
h. Summitville Tiles, Inc.; SL-15, Invisible Seal Penetrating Grout and Tile Sealer.
i. TEC; a subsidiary of H. B. Fuller Company; [TA-256 Penetrating Silicone] [TA-257 Silicone] Grout Sealer.

2.11 MIXING MORTARS AND GROUT

A. Mix mortars and grouts to comply with referenced standards and mortar and grout manufacturers' written instructions.

B. Add materials, water, and additives in accurate proportions.

C. Obtain and use type of mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures to produce mortars and grouts of uniform quality with optimum performance characteristics for installations indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of installed tile.

1. Verify that substrates for setting tile are firm, dry, clean, free of coatings that are incompatible with tile-setting materials including curing compounds and other substances that contain soap, wax, oil, or silicone; and comply with flatness tolerances required by ANSI A108.01 for installations indicated.
2. Verify that concrete substrates for tile floors installed with [adhesives] [bonded mortar bed] [or] [thin-set mortar] comply with surface finish requirements in ANSI A108.01 for installations indicated.

    a. Verify that surfaces that received a steel trowel finish have been mechanically scarified.
    b. Verify that protrusions, bumps, and ridges have been removed by sanding or grinding.

3. Verify that installation of grounds, anchors, recessed frames, electrical and mechanical units of work, and similar items located in or behind tile has been completed.
4. Verify that joints and cracks in tile substrates are coordinated with tile joint locations; if not coordinated, adjust joint locations in consultation with Architect.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Fill cracks, holes, and depressions in concrete substrates for tile floors installed with [adhesives] [or] [thin-set mortar] with trowelable leveling and patching compound specifically recommended by tile-setting material manufacturer.

B. Where indicated, prepare substrates to receive waterproofing by applying a reinforced mortar bed that complies with ANSI A108.1A and is sloped 1/4 inch per foot (1:50) toward drains.

C. Blending: For tile exhibiting color variations, verify that tile has been factory blended and packaged so tile units taken from one package show same range of colors as those taken from other packages and match approved Samples. If not factory blended, either return to manufacturer or blend tiles at Project site before installing.

D. Field-Applied Temporary Protective Coating: If indicated under tile type or needed to prevent grout from staining or adhering to exposed tile surfaces, precoat them with continuous film of temporary protective coating, taking care not to coat unexposed tile surfaces.

3.3 TILE INSTALLATION

A. Comply with TCA's "Handbook for Ceramic Tile Installation" for TCA installation methods specified in tile installation schedules. Comply with parts of the ANSI A108 Series "Specifications for Installation of Ceramic Tile" that are referenced in TCA installation methods, specified in tile installation schedules, and apply to types of setting and grouting materials used.

1. For the following installations, follow procedures in the ANSI A108 Series of tile installation standards for providing 95 percent mortar coverage:

a. Exterior tile floors.
b. Tile floors in wet areas.
c. Tile swimming pool decks.
d. Tile floors in laundries.
e. Tile floors composed of tiles 8 by 8 inches (200 by 200 mm) or larger.
f. Tile floors composed of rib-backed tiles.

B. Extend tile work into recesses and under or behind equipment and fixtures to form complete covering without interruptions unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.

C. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.

D. Provide manufacturer's standard trim shapes where necessary to eliminate exposed tile edges.

E. Jointing Pattern: Lay tile in grid pattern unless otherwise indicated. Lay out tile work and center tile fields in both directions in each space or on each wall area. Lay out tile work to minimize the use of pieces that are less than half of a tile. Provide uniform joint widths unless otherwise indicated.

1. For tile mounted in sheets, make joints between tile sheets same width as joints within tile sheets so joints between sheets are not apparent in finished work.
2. Where adjoining tiles on floor, base, walls, or trim are specified or indicated to be same size, align joints.
3. Where tiles are specified or indicated to be whole integer multiples of adjoining tiles on floor, base, walls, or trim, align joints unless otherwise indicated.

F. Joint Widths: Unless otherwise indicated, install tile with the following joint widths:

1. Ceramic Mosaic Tile: 1/16 inch (1.6 mm).
2. Quarry Tile: [1/4 inch (6.35 mm)] [3/8 inch (9.5 mm)].
3. Paver Tile: [1/4 inch (6.35 mm)] [3/8 inch (9.5 mm)].
4. Glazed Wall Tile: 1/16 inch (1.6 mm).
5. Decorative Thin Wall Tile: 1/16 inch (1.6 mm).

G. Lay out tile wainscots to dimensions indicated or to next full tile beyond dimensions indicated.

H. Expansion Joints: Provide expansion joints and other sealant-filled joints, including control, contraction, and isolation joints, where indicated. Form joints during installation of setting materials, mortar beds, and tile. Do not saw-cut joints after installing tiles.

1. Where joints occur in concrete substrates, locate joints in tile surfaces directly above them.
2. Prepare joints and apply sealants to comply with requirements in Division 07 Section "Joint Sealants."

I. Stone Thresholds: Install stone thresholds in same type of setting bed as adjacent floor unless otherwise indicated.

1. At locations where mortar bed (thickset) would otherwise be exposed above adjacent floor finishes, set thresholds in latex-portland cement mortar (thin set).
2. Do not extend [cleavage membrane] [waterproofing] [or] [crack isolation membrane] under thresholds set in [dry-set portland cement] [or] [latex-portland cement] mortar. Fill joints between such thresholds and adjoining tile set on [cleavage membrane] [waterproofing] [or] [crack isolation membrane] with elastomeric sealant.

J. Metal Edge Strips: Install [at locations indicated] [where exposed edge of tile flooring meets carpet, wood, or other flooring that finishes flush with top of tile] [where exposed edge of tile flooring meets carpet, wood, or other flooring that finishes flush with or below top of tile and no threshold is indicated].

K. Grout Sealer: Apply grout sealer to[cementitious] grout joints[in tile floors] according to grout-sealer manufacturer's written instructions. As soon as grout sealer has penetrated grout joints, remove excess sealer and sealer from tile faces by wiping with soft cloth.

3.4 TILE BACKING PANEL INSTALLATION

A. Install [cementitious backer units] [and] [fiber-cement underlayment] and treat joints according to ANSI A108.11 and manufacturer's written instructions for type of application indicated.[Use latex-portland cement mortar for bonding material unless otherwise directed in manufacturer's written instructions.]

3.5 WATERPROOFING INSTALLATION

A. Install waterproofing to comply with ANSI A108.13 and manufacturer's written instructions to produce waterproof membrane of uniform thickness and bonded securely to substrate.

B. Do not install tile or setting materials over waterproofing until waterproofing has cured and been tested to determine that it is watertight.

3.6 CRACK ISOLATION MEMBRANE INSTALLATION

A. Install crack isolation membrane to comply with ANSI A108.17 and manufacturer's written instructions to produce membrane of uniform thickness and bonded securely to substrate.

B. Do not install tile or setting materials over crack isolation membrane until membrane has cured.

3.7 CLEANING AND PROTECTING

A. Cleaning: On completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter.

1. Remove [epoxy] [and] [latex-portland cement] grout residue from tile as soon as possible.
2. Clean grout smears and haze from tile according to tile and grout manufacturer's written instructions but no sooner than 10 days after installation. Use only cleaners recommended by tile and grout manufacturers and only after determining that cleaners are safe to use by testing on samples of tile and other surfaces to be cleaned. Protect metal surfaces and plumbing fixtures from effects of cleaning. Flush surfaces with clean water before and after cleaning.
3. Remove temporary protective coating by method recommended by coating manufacturer and that is acceptable to tile and grout manufacturer. Trap and remove coating to prevent drain clogging.

B. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear. If recommended by tile manufacturer, apply coat of neutral protective cleaner to completed tile walls and floors.

C. Prohibit foot and wheel traffic from tiled floors for at least seven days after grouting is completed.

D. Before final inspection, remove protective coverings and rinse neutral protective cleaner from tile surfaces.

3.8 EXTERIOR TILE INSTALLATION SCHEDULE

A. Exterior Floor Installations:

1. Tile Installation F101: Cement mortar bed (thickset) [bonded to concrete] [over waterproof membrane on concrete] [over waterproof membrane on concrete where indicated and bonded to concrete where membrane is not indicated]; TCA F101 and [ANSI A108.1A] [ANSI A108.1B] [ANSI A108.1C].

   a. Tile Type: <Insert tile-type designation>.
   b. Thin-Set Mortar for Cured-Bed Method: [Dry-set] [Latex-] [Medium-bed, latex-] portland cement mortar.
   c. Grout: [Sand-portland cement] [Standard sanded cement] [Standard unsanded cement] [Polymer-modified sanded] [Polymer-modified unsanded] grout.

2. Tile Installation F102: Thin-set mortar [on concrete] [over waterproof membrane on concrete] [over waterproof membrane on concrete where indicated and on concrete where membrane is not indicated]; TCA F102.

   a. Tile Type: <Insert tile-type designation>.
   b. Thin-Set Mortar: [Dry-set] [Latex-] [Medium-bed, latex-] portland cement mortar.
   c. Grout: [Sand-portland cement] [Standard sanded cement] [Standard unsanded cement] [Polymer-modified sanded] [Polymer-modified unsanded] grout.

B. Exterior Wall Installations, Masonry or Concrete:

1. Tile Installation W201: Cement mortar bed (thickset) on metal lath over waterproof membrane; TCA W201 and [ANSI A108.1A] [ANSI A108.1B] [ANSI A108.1C].

   a. Tile Type: <Insert tile-type designation>.
   b. Bond Coat Mortar for Wet-Set Method: [Dry-set] [Latex-] portland cement mortar.
   c. Thin-Set Mortar for Cured-Bed Method: [Dry-set] [Latex-] portland cement mortar.

d. Grout: [Sand-portland cement] [Standard sanded cement] [Standard unsanded cement] [Polymer-modified sanded] [Polymer-modified unsanded] grout.

2. Tile Installation W202: Thin-set mortar; TCA W202.

a. Tile Type: <Insert tile-type designation>.
b. Thin-Set Mortar: [Dry-set] [Latex-] [Medium-bed, latex-] portland cement mortar.
c. Grout: [Sand-portland cement] [Standard sanded cement] [Standard unsanded cement] [Polymer-modified sanded] [Polymer-modified unsanded] grout.

3.9 INTERIOR TILE INSTALLATION SCHEDULE

A. Interior Floor Installations, Concrete Subfloor:

1. Tile Installation F111: Cement mortar bed (thickset) with cleavage membrane; TCA F111 and [ANSI A108.1A] [ANSI A108.1B] [ANSI A108.1C].

a. Tile Type: <Insert tile-type designation>.
b. Thin-Set Mortar for Cured-Bed Method: [Dry-set] [Latex-] [Medium-bed, latex-] portland cement mortar.
c. Grout: [Sand-portland cement] [Standard sanded cement] [Standard unsanded cement] [Polymer-modified sanded] [Polymer-modified unsanded] grout.

2. Tile Installation F112: Cement mortar bed (thickset) bonded to concrete; TCA F112 and [ANSI A108.1A] [ANSI A108.1B] [ANSI A108.1C].

a. Tile Type: <Insert tile-type designation>.
b. Thin-Set Mortar for Cured-Bed Method: [Dry-set] [Latex-] [Medium-bed, latex-] portland cement mortar.
c. Grout: [Sand-portland cement] [Standard sanded cement] [Standard unsanded cement] [Polymer-modified sanded] [Polymer-modified unsanded] grout.

3. Tile Installation F113: Thin-set mortar; TCA F113.

a. Tile Type: <Insert tile-type designation>.
b. Thin-Set Mortar: [Dry-set] [Latex-] [Medium-bed, latex-] portland cement mortar.
c. Grout: [Sand-portland cement] [Standard sanded cement] [Standard unsanded cement] [Polymer-modified sanded] [Polymer-modified unsanded] [Water-cleanable epoxy] grout.

4. Tile Installation F114: Cement mortar bed (thickset) with cleavage membrane; [epoxy] [furan] grout; TCA F114 and ANSI A108.1B.

a. Tile Type: <Insert tile-type designation>.
b. Thin-Set Mortar for Cured-Bed Method: [Dry-set] [Latex-] [Medium-bed, latex-] portland cement mortar.
c. Grout: [Water-cleanable epoxy] [Chemical-resistant furan] grout.

5. Tile Installation F115: Thin-set mortar; [epoxy] [furan] grout; TCA F115.

a. Tile Type: <Insert tile-type designation>.
b. Thin-Set Mortar: [Dry-set] [Latex-] [Medium-bed, latex-] portland cement mortar.
c. Grout: [Water-cleanable epoxy] [Chemical-resistant furan] grout.

6. Tile Installation F116: [Organic adhesive] [Water-cleanable, tile-setting epoxy]; TCA F116.

   a. Tile Type: <Insert tile-type designation>.
   b. Grout: [Sand-portland cement] [Standard sanded cement] [Standard unsanded cement] [Polymer-modified sanded] [Polymer-modified unsanded] [Water-cleanable epoxy] grout.

7. Tile Installation F121: Cement mortar bed (thickset) on waterproof membrane; TCA F121 and [ANSI A108.1A] [ANSI A108.1B] [ANSI A108.1C].

   a. Tile Type: <Insert tile-type designation>.
   b. Thin-Set Mortar for Cured-Bed Method: [Dry-set] [Latex-] [Medium-bed, latex-] portland cement mortar.
   c. Grout: [Sand-portland cement] [Standard sanded cement] [Standard unsanded cement] [Polymer-modified sanded] [Polymer-modified unsanded] grout.

8. Tile Installation F122: Thin-set mortar on waterproof membrane; TCA F122.

   a. Tile Type: <Insert tile-type designation>.
   b. Thin-Set Mortar: [Latex-] [Medium-bed, latex-] portland cement mortar.
   c. Grout: Polymer-modified [sanded] [unsanded] grout.

9. Tile Installation F125A: Thin-set mortar on crack isolation membrane; TCA F125A.

   a. Tile Type: <Insert tile-type designation>.
   b. Thin-Set Mortar: [Latex-] [Medium-bed, latex-] portland cement mortar.
   c. Grout: [Standard sanded cement] [Standard unsanded cement] [Polymer-modified sanded] [Polymer-modified unsanded] [Water-cleanable epoxy] grout.

10. Tile Installation F131: Water-cleanable, tile-setting epoxy; epoxy grout; TCA F131.

    a. Tile Type: <Insert tile-type designation>.
    b. Grout: Water-cleanable epoxy grout.

11. Tile Installation F132: Water-cleanable, tile-setting epoxy on cured cement mortar bed [bonded to concrete subfloor] [installed over cleavage membrane]; epoxy grout; TCA F132.

    a. Tile Type: <Insert tile-type designation>.
    b. Grout: Water-cleanable epoxy grout.

12. Tile Installation F133: [Chemical-resistant furan mortar] [Water-cleanable, tile-setting epoxy]; furan grout. TCA F133[except use water-cleanable, tile-setting epoxy instead of chemical-resistant furan mortar for setting tile].

    a. Tile Type: <Insert tile-type designation>.
    b. Grout: Chemical-resistant furan grout.

B. Interior Floor Installations, Wood Subfloor:

1. Tile Installation F121: Cement mortar bed (thickset) on waterproof membrane; TCA F121 and [ANSI A108.1A] [ANSI A108.1B] [ANSI A108.1C].

   a. Tile Type: <Insert tile-type designation>.

b. Thin-Set Mortar for Cured-Bed Method: [Dry-set] [Latex-] [Medium-bed, latex-] portland cement mortar.
c. Grout: [Sand-portland cement] [Standard sanded cement] [Standard unsanded cement] [Polymer-modified sanded] [Polymer-modified unsanded] [Water-cleanable epoxy] grout.

2. Tile Installation F141: Cement mortar bed (thickset) with cleavage membrane; TCA F141 and [ANSI A108.1A] [ANSI A108.1B] [ANSI A108.1C].

a. Tile Type: <Insert tile-type designation>.
b. Thin-Set Mortar for Cured-Bed Method: [Dry-set] [Latex-] [Medium-bed, latex-] portland cement mortar.
c. Grout: [Sand-portland cement] [Standard sanded cement] [Standard unsanded cement] [Polymer-modified sanded] [Polymer-modified unsanded] [Water-cleanable epoxy] grout.

3. Tile Installation F142: Organic adhesive; TCA F142.

a. Tile Type: <Insert tile-type designation>.
b. Grout: [Sand-portland cement] [Standard sanded cement] [Standard unsanded cement] [Polymer-modified sanded] [Polymer-modified unsanded] [Water-cleanable epoxy] grout.

4. Tile Installation F143: Water-cleanable, tile-setting epoxy; epoxy grout; TCA F143.

a. Tile Type: <Insert tile-type designation>.
b. Grout: Water-cleanable epoxy grout.

5. Tile Installation F144: Thin-set mortar on cementitious backer units or fiber cement underlayment; TCA F144.

a. Tile Type: <Insert tile-type designation>.
b. Thin-Set Mortar: [Dry-set] [Latex-] [Medium-bed, latex-] portland cement mortar.
c. Grout: [Sand-portland cement] [Standard sanded cement] [Standard unsanded cement] [Polymer-modified sanded] [Polymer-modified unsanded] [Water-cleanable epoxy] grout.

6. Tile Installation F150/160: Thin-set mortar on exterior-glue plywood; TCA F150 or TCA F160.

a. Tile Type: <Insert tile-type designation>.
b. Thin-Set Mortar: EGP latex-portland cement mortar.
c. Grout: [Sand-portland cement] [Standard sanded cement] [Standard unsanded cement] [Polymer-modified sanded] [Polymer-modified unsanded] [Water-cleanable epoxy] grout.

C. Interior Radiant Heat Floor Installations, Concrete Subfloor:

1. Tile Installation RH110: Thin-set mortar on crack isolation membrane; hydronic piping installed in concrete; TCA RH110.

a. Tile Type: <Insert tile-type designation>.
b. Thin-Set Mortar: [Latex-] [Medium-bed, latex-] portland cement mortar.

c. Grout: [Sand-portland cement] [Standard sanded cement] [Standard unsanded cement] [Polymer-modified sanded] [Polymer-modified unsanded] [Water-cleanable epoxy] grout.

2. Tile Installation RH115: Thin-set mortar; electric radiant system encapsulated in thin-set mortar; TCA RH115.

a. Tile Type: <Insert tile-type designation>.
b. Thin-Set Mortar: [Latex-] [Medium-bed, latex-] portland cement mortar.
c. Grout: [Sand-portland cement] [Standard sanded cement] [Standard unsanded cement] [Polymer-modified sanded] [Polymer-modified unsanded] [Water-cleanable epoxy] grout.

3. Tile Installation RH116: Thin-set mortar on crack isolation membrane; electric radiant system encapsulated in cementitious self-leveling underlayment; TCA RH116.

a. Tile Type: <Insert tile-type designation>.
b. Cementitious Self-Leveling Underlayment: Specified in Division 03 Section "Hydraulic Cement Underlayment."
c. Thin-Set Mortar: [Latex-] [Medium-bed, latex-] portland cement mortar.
d. Grout: [Sand-portland cement] [Standard sanded cement] [Standard unsanded cement] [Polymer-modified sanded] [Polymer-modified unsanded] [Water-cleanable epoxy] grout.

D. Interior Radiant Heat Floor Installations, Wood Subfloor:

1. Tile Installation RH130: Thin-set mortar on exterior-glue plywood; electric radiant system encapsulated in thin-set mortar; TCA RH130.

a. Tile Type: <Insert tile-type designation>.
b. Thin-Set Mortar: EGP latex-portland cement mortar.
c. Grout: [Sand-portland cement] [Standard sanded cement] [Standard unsanded cement] [Polymer-modified sanded] [Polymer-modified unsanded] [Water-cleanable epoxy] grout.

2. Tile Installation RH135: Thin-set mortar on cementitious backer units or fiber cement underlayment; electric radiant system encapsulated in thin-set mortar; TCA RH135.

a. Tile Type: <Insert tile-type designation>.
b. Thin-Set Mortar: [Latex-] [Medium-bed, latex-] portland cement mortar.
c. Grout: [Sand-portland cement] [Standard sanded cement] [Standard unsanded cement] [Polymer-modified sanded] [Polymer-modified unsanded] [Water-cleanable epoxy] grout.

3. Tile Installation RH140: Thin-set mortar on crack isolation membrane; electric radiant system encapsulated in cementitious self-leveling underlayment; TCA RH140.

a. Tile Type: <Insert tile-type designation>.
b. Cementitious Self-Leveling Underlayment: Specified in Division 03 Section "Hydraulic Cement Underlayment."
c. Thin-Set Mortar: [Latex-] [Medium-bed, latex-] portland cement mortar.
d. Grout: [Sand-portland cement] [Standard sanded cement] [Standard unsanded cement] [Polymer-modified sanded] [Polymer-modified unsanded] [Water-cleanable epoxy] grout.

E. Interior Wall Installations, Masonry or Concrete:

1. Tile Installation W202: Thin-set mortar; TCA W202.

a. Tile Type: <Insert tile-type designation>.
b. Thin-Set Mortar: [Dry-set] [Latex-] [Medium-bed, latex-] portland cement mortar.
c. Grout: [Sand-portland cement] [Standard sanded cement] [Standard unsanded cement] [Polymer-modified sanded] [Polymer-modified unsanded] [Water-cleanable epoxy] grout.

2. Tile Installation W211: Cement mortar bed (thickset) bonded to substrate; TCA W211 and [ANSI A108.1A] [ANSI A108.1B] [ANSI A108.1C].

a. Tile Type: <Insert tile-type designation>.
b. Bond Coat Mortar for Wet-Set Method: [Dry-set] [Latex-] portland cement mortar.
c. Thin-Set Mortar for Cured-Bed Method: [Dry-set] [Latex-] portland cement mortar.
d. Grout: [Sand-portland cement] [Standard sanded cement] [Standard unsanded cement] [Polymer-modified sanded] [Polymer-modified unsanded] [Water-cleanable epoxy] grout.

3. Tile Installation W221: Cement mortar bed (thickset) on metal lath[over waterproof membrane]; TCA W221 and [ANSI A108.1A] [ANSI A108.1B] [ANSI A108.1C].

a. Tile Type: <Insert tile-type designation>.
b. Bond Coat Mortar for Wet-Set Method: [Dry-set] [Latex-] portland cement mortar.
c. Thin-Set Mortar for Cured-Bed Method: [Dry-set] [Latex-] portland cement mortar.
d. Grout: [Sand-portland cement] [Standard sanded cement] [Standard unsanded cement] [Polymer-modified sanded] [Polymer-modified unsanded] [Water-cleanable epoxy] grout.

4. Tile Installation W222: One-coat cement mortar bed (thickset) on metal lath[over waterproof membrane]; TCA W222 and [ANSI A108.1A] [ANSI A108.1B] [ANSI A108.1C].

a. Tile Type: <Insert tile-type designation>.
b. Bond Coat Mortar for Wet-Set Method: [Dry-set] [Latex-] portland cement mortar.
c. Thin-Set Mortar for Cured-Bed Method: [Dry-set] [Latex-] portland cement mortar.
d. Grout: [Sand-portland cement] [Standard sanded cement] [Standard unsanded cement] [Polymer-modified sanded] [Polymer-modified unsanded] grout.

5. Tile Installation W223: Organic adhesive; TCA W223.

a. Tile Type: <Insert tile-type designation>.
b. Grout: [Sand-portland cement] [Standard sanded cement] [Standard unsanded cement] [Polymer-modified sanded] [Polymer-modified unsanded] grout.

F. Interior Wall Installations, Wood Studs or Furring:

1. Tile Installation W221: Cement mortar bed (thickset)[over waterproof membrane] on solid backing; TCA W221 and [ANSI A108.1A] [ANSI A108.1B] [ANSI A108.1C].

a. Tile Type: <Insert tile-type designation>.
b. Bond Coat Mortar for Wet-Set Method: [Dry-set] [Latex-] portland cement mortar.
c. Thin-Set Mortar for Cured-Bed Method: [Dry-set] [Latex-] portland cement mortar.

d. Grout: [Sand-portland cement] [Standard sanded cement] [Standard unsanded cement] [Polymer-modified sanded] [Polymer-modified unsanded] [Water-cleanable epoxy] grout.

2. Tile Installation W222: One-coat cement mortar bed (thickset)[over waterproof membrane] on solid backing; TCA W222 and [ANSI A108.1A] [ANSI A108.1B] [ANSI A108.1C].

a. Tile Type: <Insert tile-type designation>.
b. Bond Coat Mortar for Wet-Set Method: [Dry-set] [Latex-] portland cement mortar.
c. Thin-Set Mortar for Cured-Bed Method: [Dry-set] [Latex-] portland cement mortar.
d. Grout: [Sand-portland cement] [Standard sanded cement] [Standard unsanded cement] [Polymer-modified sanded] [Polymer-modified unsanded] [Water-cleanable epoxy] grout.

3. Tile Installation W223: Organic adhesive on solid backing; TCA W223.

a. Tile Type: <Insert tile-type designation>.
b. Grout: [Sand-portland cement] [Standard sanded cement] [Standard unsanded cement] [Polymer-modified sanded] [Polymer-modified unsanded] grout.

4. Tile Installation W231: Cement mortar bed (thickset); TCA W231 and [ANSI A108.1A] [ANSI A108.1B] [ANSI A108.1C].

a. Tile Type: <Insert tile-type designation>.
b. Bond Coat Mortar for Wet-Set Method: [Dry-set] [Latex-] portland cement mortar.
c. Thin-Set Mortar for Cured-Bed Method: [Dry-set] [Latex-] portland cement mortar.
d. Grout: [Sand-portland cement] [Standard sanded cement] [Standard unsanded cement] [Polymer-modified sanded] [Polymer-modified unsanded] grout.

5. Tile Installation W243: Thin-set mortar on gypsum board; TCA W243.

a. Tile Type: <Insert tile-type designation>.
b. Thin-Set Mortar: [Dry-set] [Latex-] portland cement mortar.
c. Grout: [Sand-portland cement] [Standard sanded cement] [Standard unsanded cement] [Polymer-modified sanded] [Polymer-modified unsanded] grout.

6. Tile Installation W244: Thin-set mortar on cementitious backer units or fiber cement underlayment[over cleavage membrane]; TCA W244.

a. Tile Type: <Insert tile-type designation>.
b. Thin-Set Mortar: [Dry-set] [Latex-] portland cement mortar.
c. Grout: [Sand-portland cement] [Standard sanded cement] [Standard unsanded cement] [Polymer-modified sanded] [Polymer-modified unsanded] [Water-cleanable epoxy] grout.

7. Tile Installation W245: [Thin-set mortar] [Organic adhesive] on coated glass-mat, water-resistant gypsum backer board; TCA W245.

a. Tile Type: <Insert tile-type designation>.
b. Thin-Set Mortar: [Dry-set] [Latex-] portland cement mortar.
c. Grout: [Sand-portland cement] [Standard sanded cement] [Standard unsanded cement] [Polymer-modified sanded] [Polymer-modified unsanded] [Water-cleanable epoxy] grout.

G. Interior Wall Installations, Metal Studs or Furring:

1. Tile Installation W221: Cement mortar bed (thickset)[over waterproof membrane] on solid backing; TCA W221 and [ANSI A108.1A] [ANSI A108.1B] [ANSI A108.1C].

   a. Tile Type: <Insert tile-type designation>.
   b. Bond Coat Mortar for Wet-Set Method: [Dry-set] [Latex-] portland cement mortar.
   c. Thin-Set Mortar for Cured-Bed Method: [Dry-set] [Latex-] portland cement mortar.
   d. Grout: [Sand-portland cement] [Standard sanded cement] [Standard unsanded cement] [Polymer-modified sanded] [Polymer-modified unsanded] [Water-cleanable epoxy] grout.

2. Tile Installation W222: One-coat cement mortar bed (thickset)[over waterproof membrane] on solid backing; TCA W222 and [ANSI A108.1A] [ANSI A108.1B] [ANSI A108.1C].

   a. Tile Type: <Insert tile-type designation>.
   b. Bond Coat Mortar for Wet-Set Method: [Dry-set] [Latex-] portland cement mortar.
   c. Thin-Set Mortar for Cured-Bed Method: [Dry-set] [Latex-] portland cement mortar.
   d. Grout: [Sand-portland cement] [Standard sanded cement] [Standard unsanded cement] [Polymer-modified sanded] [Polymer-modified unsanded] [Water-cleanable epoxy] grout.

3. Tile Installation W223: Organic adhesive on solid backing; TCA W223.

   a. Tile Type: <Insert tile-type designation>.
   b. Grout: [Sand-portland cement] [Standard sanded cement] [Standard unsanded cement] [Polymer-modified sanded] [Polymer-modified unsanded] grout.

4. Tile Installation W241: Cement mortar bed (thickset); TCA W241 and ANSI A108.1B.

   a. Tile Type: <Insert tile-type designation>.
   b. Thin-Set Mortar for Cured-Bed Method: [Dry-set] [Latex-] portland cement mortar.
   c. Grout: [Sand-portland cement] [Standard sanded cement] [Standard unsanded cement] [Polymer-modified sanded] [Polymer-modified unsanded] grout.

5. Tile Installation W242: Organic adhesive on gypsum board; TCA W242.

   a. Tile Type: <Insert tile-type designation>.
   b. Grout: [Polymer-modified sanded] [Polymer-modified unsanded] grout.

6. Tile Installation W243: Thin-set mortar on gypsum board; TCA W243.

   a. Tile Type: <Insert tile-type designation>.
   b. Thin-Set Mortar: [Dry-set] [Latex-] portland cement mortar.
   c. Grout: [Sand-portland cement] [Standard sanded cement] [Standard unsanded cement] [Polymer-modified sanded] [Polymer-modified unsanded] grout.

7. Tile Installation W244: Thin-set mortar on cementitious backer units or fiber cement underlayment[over cleavage membrane]; TCA W244.

   a. Tile Type: <Insert tile-type designation>.
   b. Thin-Set Mortar: [Dry-set] [Latex-] portland cement mortar.

c. Grout: [Sand-portland cement] [Standard sanded cement] [Standard unsanded cement] [Polymer-modified sanded] [Polymer-modified unsanded] [Water-cleanable epoxy] grout.

8. Tile Installation W245: [Thin-set mortar] [Organic adhesive] on coated glass-mat, water-resistant gypsum backer board; TCA W245.

a. Tile Type: <Insert tile-type designation>.
b. Thin-Set Mortar: [Dry-set] [Latex-] portland cement mortar.
c. Grout: [Sand-portland cement] [Standard sanded cement] [Standard unsanded cement] [Polymer-modified sanded] [Polymer-modified unsanded] [Water-cleanable epoxy] grout.

H. Bathtub Wall Installations, [Wood] [Metal] Studs or Furring:

1. Tile Installation B413: [Thin-set mortar] [Organic adhesive] on water-resistant gypsum board; TCA B413.

a. Tile Type: <Insert tile-type designation>.
b. Thin-Set Mortar: [Dry-set] [Latex-] portland cement mortar.
c. Grout: [Sand-portland cement] [Standard sanded cement] [Standard unsanded cement] [Polymer-modified sanded] [Polymer-modified unsanded] grout.

I. Bathtub/Shower Wall Installations, [Wood] [Metal] Studs or Furring:

1. Tile Installation B411: Cement mortar bed (thickset); TCA B411 and ANSI A108.1A.

a. Tile Type: <Insert tile-type designation>.
b. Bond Coat Mortar for Wet-Set Method: [Dry-set] [Latex-] portland cement mortar.
c. Grout: [Sand-portland cement] [Standard sanded cement] [Standard unsanded cement] [Polymer-modified sanded] [Polymer-modified unsanded] grout.

2. Tile Installation B412: Thin-set mortar on cementitious backer units or fiber cement underlayment; TCA B412.

a. Tile Type: <Insert tile-type designation>.
b. Thin-Set Mortar: [Dry-set] [Latex-] portland cement mortar.
c. Grout: [Sand-portland cement] [Standard sanded cement] [Standard unsanded cement] [Polymer-modified sanded] [Polymer-modified unsanded] [Water-cleanable epoxy] grout.

3. Tile Installation B419: [Thin-set mortar] [Organic adhesive] on coated glass-mat, water-resistant backer board; TCA B419.

a. Tile Type: <Insert tile-type designation>.
b. Thin-Set Mortar: [Dry-set] [Latex-] portland cement mortar.
c. Grout: [Sand-portland cement] [Standard sanded cement] [Standard unsanded cement] [Polymer-modified sanded] [Polymer-modified unsanded] [Water-cleanable epoxy] grout.

J. Shower Receptor and Wall Installations, Concrete or Masonry:

1. Tile Installation B414: Cement mortar bed (thickset); TCA B414 and [ANSI A108.1A] [ANSI A108.1B] [ANSI A108.1C].

a. Tile Type: <Insert tile-type designation>.
b. Bond Coat Mortar for Wet-Set Method: [Dry-set] [Latex-] portland cement mortar.
c. Thin-Set Mortar for Cured-Bed Method: [Dry-set] [Latex-] portland cement mortar.
d. Grout: [Sand-portland cement] [Standard sanded cement] [Standard unsanded cement] [Polymer-modified sanded] [Polymer-modified unsanded] grout.

2. Tile Installation B421: Thin-set mortar on waterproof membrane; TCA B421.

a. Tile Type: <Insert tile-type designation>.
b. Thin-Set Mortar: Latex-portland cement mortar.
c. Grout: [Sand-portland cement] [Standard sanded cement] [Standard unsanded cement] [Polymer-modified sanded] [Polymer-modified unsanded] grout.

3. Tile Installation B422: Thin-set mortar on waterproof membrane with integrated bonding flange for bonded membranes; TCA B422.

a. Tile Type: <Insert tile-type designation>.
b. Thin-Set Mortar: [Dry-set] [Latex-] portland cement mortar.
c. Grout: [Sand-portland cement] [Standard sanded cement] [Standard unsanded cement] [Polymer-modified sanded] [Polymer-modified unsanded] grout.

K. Shower Receptor and Wall Installations, [Wood] [Metal] Studs or Furring:

1. Tile Installation B414: Cement mortar bed (thickset); TCA B414 and [ANSI A108.1A] [ANSI A108.1B] [ANSI A108.1C].

a. Tile Type: <Insert tile-type designation>.
b. Bond Coat Mortar for Wet-Set Method: [Dry-set] [Latex-] portland cement mortar.
c. Thin-Set Mortar for Cured-Bed Method: [Dry-set] [Latex-] portland cement mortar.
d. Grout: [Sand-portland cement] [Standard sanded cement] [Standard unsanded cement] [Polymer-modified sanded] [Polymer-modified unsanded] grout.

2. Tile Installation B415: Thin-set mortar on cementitious backer units or fiber cement underlayment; TCA B415.

a. Tile Type: <Insert tile-type designation>.
b. Thin-Set Mortar: [Dry-set] [Latex-] portland cement mortar.
c. Grout: [Sand-portland cement] [Standard sanded cement] [Standard unsanded cement] [Polymer-modified sanded] [Polymer-modified unsanded] grout.

3. Tile Installation B420: Thin-set mortar on coated glass-mat, water-resistant backer board; TCA B420.

a. Tile Type: <Insert tile-type designation>.
b. Thin-Set Mortar: [Dry-set] [Latex-] portland cement mortar.
c. Grout: [Sand-portland cement] [Standard sanded cement] [Standard unsanded cement] [Polymer-modified sanded] [Polymer-modified unsanded] grout.

4. Tile Installation B421: Thin-set mortar on waterproof membrane over cementitious backer units or fiber cement underlayment; TCA B421.

a. Tile Type: <Insert tile-type designation>.
b. Thin-Set Mortar: Latex-portland cement mortar.
c. Grout: [Sand-portland cement] [Standard sanded cement] [Standard unsanded cement] [Polymer-modified sanded] [Polymer-modified unsanded] grout.

5. Tile Installation B422: Thin-set mortar on waterproof membrane over cementitious backer units or fiber cement underlayment with integrated bonding flange for bonded membranes; TCA B422.

   a. Tile Type: <Insert tile-type designation>.
   b. Thin-Set Mortar: Latex-portland cement mortar.
   c. Grout: [Sand-portland cement] [Standard sanded cement] [Standard unsanded cement] [Polymer-modified sanded] [Polymer-modified unsanded] grout.

END OF SECTION 093000

END OF SECTION 09 30 00

SECTION 09 51 10 - ACOUSTICAL TILE CEILINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Acoustical tiles for ceilings.
2. Concealed suspension systems.

B. Related Requirements:

1. Division 09 Section "Gypsum Board".
2. Division 21-28 for light fixtures, sprinklers and air distribution components.

C. Products furnished, but not installed under this Section, include anchors, clips, and other ceiling attachment devices to be cast in concrete.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. LEED Submittals:

1. Product Data for Credit MR 4: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating costs for each product having recycled content.
2. Product Data for Credit EQ 4.1: For adhesives and sealants, documentation including printed statement of VOC content.
3. Laboratory Test Reports for Credit EQ 4: For ceiling systems, 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."

C. Samples: For each exposed product and for each color and texture specified, 6-inches- (150-mm-) in size.

D. Samples for Initial Selection: For components with factory-applied color finishes.

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E. Samples for Verification: For each component indicated and for each exposed finish required, prepared on Samples of size indicated below.

1. Acoustical Tile: Set of full-size Samples of each type, color, pattern, and texture.
2. Concealed Suspension-System Members: 6-inch- (150-mm-) long Sample of each type.
3. Exposed Moldings and Trim: Set of 6-inch- (150-mm-) long Samples of each type and color.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Ceiling suspension-system members.
2. Method of attaching hangers to building structure.

a. Furnish layouts for cast-in-place anchors, clips, and other ceiling attachment devices whose installation is specified in other Sections.

3. Size and location of initial access modules for acoustical tile.
4. Ceiling-mounted items including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.
5. Minimum Drawing Scale: 1/8 inch = 1 foot (1:96).

B. Qualification Data: For testing agency.

C. Product Test Reports: For each acoustical tile ceiling, for tests performed by manufacturer and witnessed by a qualified testing agency.

D. Evaluation Reports: For each acoustical tile ceiling suspension system and anchor and fastener type, from ICC-ES.

E. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For finishes to include in maintenance manuals.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Acoustical Ceiling Units: Full-size tiles equal to 2 percent of quantity installed.
2. Suspension-System Components: Quantity of each concealed grid and exposed component equal to 2 percent of quantity installed.

1.8 QUALITY ASSURANCE

A. Testing Agency Qualifications: Qualified according to the National Voluntary Laboratory Accreditation Program (NVLAP) for testing indicated.

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B. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Build mockup of typical ceiling area as shown on Drawings.
2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Deliver acoustical tiles, suspension-system components, and accessories to Project site in original, unopened packages and store them in a fully enclosed, conditioned space where they will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.

B. Before installing acoustical tiles, permit them to reach room temperature and stabilized moisture content.

C. Handle acoustical tiles carefully to avoid chipping edges or damaging units in any way.

1.10 FIELD CONDITIONS

A. Environmental Limitations: Do not install acoustical tile ceilings until spaces are enclosed and weatherproof, wet work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for the Project when occupied for its intended use.

1. Pressurized Plenums: Operate ventilation system for not less than 48 hours before beginning acoustical tile ceiling installation.

PART 2 - PRODUCTS

2.1 DELIVERY, STORAGE, AND HANDLING

A. Deliver acoustical tiles, suspension-system components, and accessories to Project site in original, unopened packages and store them in a fully enclosed, conditioned space where they will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.

B. Before installing acoustical tiles, permit them to reach room temperature and stabilized moisture content.

C. Handle acoustical tiles carefully to avoid chipping edges or damaging units in any way.

2.2 FIELD CONDITIONS

A. Environmental Limitations: Do not install acoustical tile ceilings until spaces are enclosed and weatherproof, wet work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

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1. Pressurized Plenums: Operate ventilation system for not less than 48 hours before beginning acoustical tile ceiling installation.

2. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.

2.3 ACOUSTICAL TILES, GENERAL

A. Low-Emitting Materials: Acoustical tile ceilings 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."

B. Source Limitations:

1. Acoustical Ceiling Tile: Obtain each type from single source from single manufacturer.
2. Suspension System: Obtain each type from single source from single manufacturer.

C. Source Limitations: Obtain each type of acoustical ceiling tile and supporting suspension system from single source from single manufacturer.

D. Acoustical Tile Standard: Provide manufacturer's standard tiles of configuration indicated that comply with ASTM E 1264 classifications as designated by types, patterns, acoustical ratings, and light reflectances unless otherwise indicated.

1. Mounting Method for Measuring NRC: Type E-400; plenum mounting in which face of test specimen is 15-3/4 inches (400 mm) away from test surface according to ASTM E 795.

E. Acoustical Tile Colors and Patterns: Match appearance characteristics indicated for each product type.

1. Where appearance characteristics of acoustical tiles are indicated by referencing pattern designations in ASTM E 1264 and not manufacturers' proprietary product designations, provide products selected by Architect from each manufacturer's full range that comply with requirements indicated for type, pattern, color, light reflectance, acoustical performance, edge detail, and size.

2.4 ACOUSTICAL TILES

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following. If not indicated, provide Tundra #303 tegular 24” x 24” x 5/8” thick at 1.1 lbs/sf, as manufactured by Armstrong World Industries:

1. BPB Celotex.
2. CertainTeed Corp.
3. USG Interiors, Inc.; Subsidiary of USG Corporation.

B. Color: As indicated on Drawings, if not indicated on drawings, provide white.

C. Broad Spectrum Antimicrobial Fungicide and Bactericide Treatment: Provide acoustical tiles treated with manufacturer's standard antimicrobial formulation that inhibits fungus, mold, mildew, and gram-positive and gram-negative bacteria and showing no mold, mildew, or

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bacterial growth when tested according to ASTM D 3273 and evaluated according to ASTM D 3274 or ASTM G 21.

2.5 METAL SUSPENSION SYSTEMS, GENERAL

A. Metal Suspension-System Standard: Provide manufacturer's standard metal suspension systems of types, structural classifications, and finishes indicated that comply with applicable requirements in ASTM C 635/C 635M as applicable to the type of suspension system required for the type of ceiling units indicated. Coordinate with other work supported by or penetrating through the ceilings, including light fixtures, HVAC equipment, and partition system (if any).

B. Attachment Devices: Size for five times the design load indicated in ASTM C 635/C 635M, Table 1, "Direct Hung," unless otherwise indicated. Comply with seismic design requirements.

1. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hangers of type indicated, and with capability to sustain, without failure, a load equal to 10 times that imposed by ceiling construction, as determined by testing according to ASTM E 1190, conducted by a qualified testing and inspecting agency.

C. Wire Hangers, Braces, and Ties: Provide wires complying with the following requirements:

1. Zinc-Coated, Carbon-Steel Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper.
2. Size: Select wire diameter so its stress at three times hanger design load (ASTM C 635/C 635M, Table 1, "Direct Hung") will be less than yield stress of wire, but provide not less than 12 gauge diameter wire.

D. Hanger Rods: Mild steel, zinc coated or protected with rust-inhibitive paint.

E. Angle Hangers: Angles with legs not less than 7/8 inch (22 mm) wide; formed with 0.04-inch- (1-mm-) thick, galvanized-steel sheet complying with ASTM A 653/A 653M, G90 (Z275) coating designation; with bolted connections and 5/16-inch- (8-mm-) diameter bolts.

2.6 METAL SUSPENSION SYSTEM

A. Basis-of-Design Product: Subject to compliance with requirements, provide same as acoustical ceiling manufacturer or comparable product by one of the following:

1. Chicago Metallic Corporation.
2. Donn Products.
3. National Rolling Mills Company.
4. USG Interiors, Inc.; Subsidiary of USG Corporation.

B. Type of System: Either Direct-Hung, Double-Web Suspension System or Indirect Hung Suspension System (as Contractor’s option): Main and cross runners roll formed from and capped with cold-rolled steel sheet, prepainted, electrolytically zinc coated, or hot-dip galvanized according to ASTM A 653/A 653M, G30 (Z90) coating designation.

1. Structural Classification: Intermediate-duty system.
2. Indirect-Hung Suspension System, conform to the following:

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a. Carrying Channels: 1-1/2" steel channels, hot-rolled or cold-rolled, not less than 0.475 lbs. per lin. Ft.

C. Concealed Suspension System: Manufacturer's standard galvanized steel system of runners, cross runners, splines and accessories.

1. Access: Manufacturer's standard total access system, either up-acting or down-acting (each 12 x 24 unit independently removable.)
2. Provide access units for up to a maximum of 25% of the total ceiling area.

D. Exposed Suspension System: Manufacturer's standard exposed runners, cross-runners and accessories, of the types and profiles indicated, with exposed cross-runners coped to lay flush with main runners.

1. Finish of Exposed Members: Provide uniform factory-applied finish on exposed surfaces of ceiling suspension system including moldings, trim and accessories.
2. Finish: Manufacturer's standard baked enamel finish, white unless otherwise selected by Architect.

2.7 METAL EDGE MOLDINGS AND TRIM

A. Edge Moldings: Provide manufacturer standard angle moldings; in finish to match exposed system. Provide manufacturer's standard angle moldings in finish to match exposed system.

2.8 ACOUSTICAL SEALANT

A. Acoustical Sealant: A heavy-bodied, non-shrinking, non-drying, non-sag, grade mastic compound intended for interior sealing of concealed construction joints.

PART 3 - EXECUTION

3.1 EXAMINATION AND PREPARATION WORK

A. Examine substrates, areas, and conditions, including structural framing and substrates to which acoustical tile ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage and for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine acoustical tiles before installation. Reject acoustical tiles that are wet, moisture damaged, or mold damaged.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

D. Verify that layout of hangers will not interfere with other work; make adjustments in layout as necessary.

E. Do not begin ceiling installation until services above ceiling are complete except for final trim.

F. Notify Architect of unsatisfactory conditions before proceeding.

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G. Measure each ceiling area and establish layout of acoustical tiles to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width tiles at borders, and comply with layout shown on reflected ceiling plans.

H. Locate system on room axis according to reflected ceiling plan.

3.2 INSTALLATION OF CEILING TILES

A. General: Install acoustical panel ceilings to comply with ASTM C 636/C 636M and seismic design requirements indicated, according to manufacturer's written instructions and CISCA's "Ceiling Systems Handbook."

1. Fire-Rated Assembly: Install fire-rated ceiling systems according to tested fire-rated design.

B. Install acoustical panels in accordance with manufacturer’s written instructions.

C. Lay panels flat into the tee grid. Scribe and cut panels for accurate fit at perimeter and around penetrations.

D. Hold tile field in compression when performing cuts.

E. Install acoustical panels after above-ceiling work is complete. Install panels level, in uniform plane, and free from warp, twists, and dents.

F. Installation Tolerance: Maximum variation from flat and level surface is 1:360.

3.3 INSTALLATION OF SUSPENSION SYSTEM

A. General:

1. Conform to the requirements of CISCA (AC) – Acoustical Ceilings: Use and Practice.
2. Install in accordance with manufacturer’s instructions and ASTM C 636 and ASTM E 580.
3. Attach hangers to structural members. Do not support ceilings directly from permanent metal forms or steel floor or roof deck.
4. Space hangers not more than 48 inches o.c. in both directions.
5. 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.
6. 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.
7. Support fixture loads using supplementary hangers located within 6 inches of each corner, or support components independently. Do not eccentrically load system or induce rotation of runners.
8. Perimeter Trim: Install at intersection of ceiling and vertical surfaces and at junctions with other interruptions.

B. Suspend ceiling hangers from building's structural members and as follows:

1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.

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2. Splay hangers only where required[**and, if permitted with fire-resistance-rated ceilings,**] to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
3. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension-system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices.
4. Secure wire hangers to ceiling suspension members and to supports above with a minimum of three tight turns. Connect hangers directly either to structures or to inserts, eye screws, or other devices that are secure and appropriate for substrate and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
5. Secure flat, angle, channel, and rod hangers to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices that are secure and appropriate for both the structure to which hangers are attached and the type of hanger involved. Install hangers in a manner that will not cause them to deteriorate or fail due to age, corrosion, or elevated temperatures.
6. Do not support ceilings directly from permanent metal forms or floor deck. Fasten hangers to cast-in-place hanger inserts, postinstalled mechanical or adhesive anchors, or power-actuated fasteners that extend through forms into concrete.
7. When steel framing does not permit installation of hanger wires at spacing required, install carrying channels or other supplemental support for attachment of hanger wires.
8. Do not attach hangers to steel deck tabs.
9. Do not attach hangers to steel roof deck. Attach hangers to structural members.
10. Space hangers not more than 48 inches (1200 mm) o.c. along each member supported directly from hangers unless otherwise indicated; provide hangers not more than 8 inches (200 mm) from ends of each member.
11. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.

C. Secure bracing wires to ceiling suspension members and to supports with a minimum of four tight turns. Suspend bracing from building's structural members as required for hangers without attaching to permanent metal forms, steel deck, or steel deck tabs. Fasten bracing wires into concrete with cast-in-place or postinstalled anchors.

D. Install edge moldings and trim of type indicated at perimeter of acoustical tile ceiling area and where necessary to conceal edges of acoustical tiles.

1. Apply acoustical sealant in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.
2. Screw attach moldings to substrate at intervals not more than 16 inches (400 mm) o.c. and not more than 3 inches (75 mm) from ends, leveling with ceiling suspension system to a tolerance of 1/8 inch in 12 feet (3.2 mm in 3.6 m). Miter corners accurately and connect securely.
3. Do not use exposed fasteners, including pop rivets, on moldings and trim.

E. Install suspension-system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.

F. Arrange directionally patterned acoustical tiles as follows:

1. As indicated on reflected ceiling plans.
2. Install tiles with pattern running in one direction parallel to long or short axis of space.
3. Install tiles in a basket-weave pattern.

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G. Install acoustical tiles in coordination with suspension system and exposed moldings and trim. Place splines or suspension-system flanges into kerfed edges so tile-to-tile joints are closed by double lap of material.

1. Fit adjoining tile to form flush, tight joints. Scribe and cut tile for accurate fit at borders and around penetrations through tile.
2. Hold tile field in compression by inserting leaf-type, spring-steel spacers between tile and moldings, spaced 12 inches (305 mm) o.c.
3. Protect lighting fixtures and air ducts to comply with requirements indicated for the indicated fire-resistance-rated assembly design.

3.4 CLEANING

A. Clean exposed surfaces of acoustical tile ceilings, including trim and edge moldings. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage. Remove and replace tiles and other ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

B. Protect installed acoustical panel ceilings until completion of project.

END OF SECTION 09 51 10

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SECTION 09 67 26 - EPOXY FLOORING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This section includes the following:

1. Quartz flooring system as shown on the drawings and in schedules.

B. Related sections include the following:

1. Cast-in-Place Concrete, section 03 30 00
2. Concrete Curing, section 03 39 00

1.3 SYSTEM DESCRIPTION

A. The work shall consist of preparation of the substrate, the furnishing and application of an epoxy based multi roller applied flooring system with Q28 or Q11 colored quartz aggregate and urethane topcoat. The system shall have the color and texture as specified by the Owner with a nominal thickness of 1/8 inch. It shall be applied to the prepared area(s) as defined in the plans strictly in accordance with the Manufacturer's recommendations.

B. Cove base (if required) to be applied where noted on plans and per manufacturers standard details unless otherwise noted.

1.4 SUBMITTALS

A. Product Data: Latest edition of Manufacturer's literature including performance data and installation procedures.

B. Manufacturer’s Material Safety Data Sheet (MSDS) for each product being used.

C. Samples: A 3 x 3 inch square sample of the proposed system. Color, texture, and thickness shall be representative of overall appearance of finished system subject to normal tolerances.

1.5 QUALITY ASSURANCE

A. The Manufacturer shall have a minimum of 10 years’ experience in the production, sales, and technical support of epoxy and urethane industrial flooring and related materials.

B. The Applicator shall have experience in installation of the flooring system as confirmed by the manufacturer in all phases of surface preparation and application of the product specified.

C. No requests for substitutions shall be considered that would change the generic type of the specified System.

D. System shall be in compliance with requirements of United States Department of Agriculture (USDA), Food, Drug Administration (FDA), and local Health Department.

E. System shall be in compliance with the Indoor Air Quality requirements of California section

01350 as verified by a qualified independent testing laboratory.

F. A pre-installation conference shall be held between Applicator, General Contractor and the Owner to review and clarification of this specification, application procedure, quality control, inspection and acceptance criteria and production schedule.

1.6 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Packing and Shipping

1. All components of the system shall be delivered to the site in the Manufacturer's packaging, clearly identified with the product type and batch number.

B. Storage and Protection

1. The Applicator shall be provided with a storage area for all components. The area shall be between 60 F and 90 F, dry, out of direct sunlight and in accordance with the Manufacturer's recommendations and relevant health and safety regulations.
2. Copies of Material Safety Data Sheets (MSDS) for all components shall be kept on site for review by the Engineer or other personnel.

C. Waste Disposal

1. The Applicator shall be provided with adequate disposal facilities for non-hazardous waste generated during installation of the system.

1.7 PROJECT CONDITIONS

A. Site Requirements

1. Application may proceed while air, material and substrate temperatures are between 60 F and 90 F providing the substrate temperature is above the dew point. Outside of this range, the Manufacturer shall be consulted.
2. The relative humidity in the specific location of the application shall be less than 85 % and the surface temperature shall be at least 5 F above the dew point.
3. The Applicator shall ensure that adequate ventilation is available for the work area.
4. The Applicator shall be supplied with adequate lighting equal to the final lighting level during the preparation and installation of the system.

B. Conditions of new concrete to be coated with epoxy material.

1. Concrete shall be moisture cured for a minimum of 7 days and have fully cured a minimum of twenty eight days in accordance with ACI-308 prior to the application of the coating system pending moisture tests.
2. Concrete shall have a flat rubbed finish, float or light steel trowel finish (a hard steel trowel finish is neither necessary or desirable).
3. Sealers and curing agents should not to be used.
4. Concrete surfaces on grade shall have been constructed with a vapor barrier to protect against the effects of vapor transmission and possible delamination of the system.

C. Safety Requirements

1. All open flames and spark-producing equipment shall be removed from the work area prior to commencement of application.
2. "No Smoking" signs shall be posted at the entrances to the work area.
3. The Owner shall be responsible for the removal of foodstuffs from the work area.
4. Non-related personnel in the work area shall be kept to a minimum.

1.8 WARRANTY

A. Dur-A-Flex, Inc. warrants that material shipped to buyers at the time of shipment substantially free from material defects and will perform substantially to Dur-A-Flex, Inc. published literature if used in accordance with the latest prescribed procedures and prior to the expiration date.
B. Dur-A-Flex, Inc. liability with respect to this warranty is strictly limited to the value of the material purchase.

PART 2 – PRODUCTS

2.1 FLOORING

A. Dur-A-Flex, Inc, Dur-A-Quartz, Epoxy-Based seamless flooring system.
   1. System Materials:
      a. Primer: Dur-A-Flex, Inc, Dur-A-Glaze #4 WB resin and hardener.
      b. Broadcast Coats: Dur-A-Flex, Inc, Dur-A-Glaze #4 resin and hardener.
      c. The quartz aggregate shall be Dur-A-Flex, Inc. Q-28 or Q-11 colored quartz aggregate.
      d. Grout Coat: Dur-A-Flex, Inc. Dur-A-Glaze #4 resin and Water Clear hardener.
      e. Topcoat: Dur-A-Flex, Inc. Armor Top resin, hardener and grit.

   2. Patch Materials
      a. Shallow Fill and Patching: Use Dur-A-Flex, Inc. Dur-A-Glaze # 4 Cove-Rez.
      b. Deep Fill and Sloping Material (over ¼ inch): Use Dur-A-Flex, Inc. Dur-A-Crete.

2.2 MANUFACTURER

A. Dur-A-Flex, Inc., 95 Goodwin Street, East Hartford, CT 06108, Phone: (860) 528-9838, Fax: (860) 528-2802
B. Manufacturer of Approved System shall be single source and made in the USA.

2.3 PRODUCT REQUIREMENTS

A. Primer	Dur-A-Glaze #4 WB
1. Percent Solids	56 %
2. VOC	2 g/L
3. Bond Strength to Concrete ASTM D 4541	550 psi, substrates fails
4. Hardness, ASTM D 3363	3H
5. Elongation, ASTM D 2370	9 %
6. Flexibility (1/4: Cylindrical mandrel), ASTM D	1737 Pass
7. Impact Resistance, MIL D-2794	>160
6. Abrasion Resistance ASTM D 4060, CS 17 wheel, 1,000 g Load	30 mg loss
B. Broadcast, and Grout Coat	Dur-A-Glaze #4
1. Percent Solids	100 %
2. VOC	3.8 g/L

3. Compressive Strength, ASTM D 695	17,500 psi
4. Tensile Strength, ASTM D 638	2,100 psi
5. Flexural Strength, ASTM D 790	5,100 psi
6. Abrasion Resistance, ASTM D 4060	
C-10 Wheel, 1,000 gm load, 1,000 cycles	29 mg loss
7. Flame Spread/NFPA-101, ASTM E 84	Class A
8. Impact Resistance MIL D-24613	0.0007 inches, no cracking or delamination
9. Water Absorption. MIL D-24613	Nil
10. Potlife @ 70 F	20 minutes

C. Topcoat	Armor Top
1. Percent Solids	95 %
2. VOC	0 g/L
3. Tensile Strength, ASTM D 2370	7,000 psi
4. Adhesion, ASTM 4541	Substrate Failure
5. Hardness, ASTM D 3363	4H
6. 60^0 Gloss ASTM D 523	70
7. Abrasion Resistance, ASTM D4060	Gloss Satin
CS 17 wheel (1,000 g load) 1,000 cycles	4 - 8 mg loss with grit
	10 - 12 mg loss without grit
8. Pot Life, 70 F, 50% RH	2 Hours
9. Full Chemical Resistance	7 days

PART 3 – EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas and conditions, with Applicator present, for compliance with requirements for maximum moisture content, installation tolerances and other conditions affecting flooring performance.

1. Verify that substrates and conditions are satisfactory for flooring installation and comply with requirements specified.

3.2 PREPARATION

A. General

1. New and existing concrete surfaces shall be free of oil, grease, curing compounds, loose particles, moss, algae growth, laitance, friable matter, dirt, and bituminous products.
2. Moisture Testing: Perform tests recommended by manufacturer and as follows.
.
   a. Perform relative humidity test using is situ probes, ASTM F 2170. Proceed with installation only after substrates have a maximum 75% relative humidity level measurement.
   b. If the relative humidity exceeds 75% then Dur-A-Flex, Inc Dur-A-Glaze MVP Primer moisture mitigation system must be installed prior to resinous flooring installation. Slab-on grade substrates without a vapor barrier may also require the moisture mitigation system.
3. There shall be no visible moisture present on the surface at the time of application of the system. Compressed oil-free air and/or a light passing of a propane torch may be used to dry the substrate.
4. Mechanical surface preparation

a. Shot blast all surfaces to receive flooring system with a mobile steel shot, dust recycling machine (Blastrac or equal). All surface and embedded accumulations of paint, toppings hardened concrete layers, laitance, power trowel finishes and other similar surface characteristics shall be completely removed leaving a bare concrete surface having a minimum profile of CSP 4-5 as described by the International Concrete Repair Institute.
b. Floor areas inaccessible to the mobile blast machines shall be mechanically abraded to the same degree of cleanliness, soundness and profile using diamond grinders, needle guns, bush hammers, or other suitable equipment.
c. Where the perimeter of the substrate to be coated is not adjacent to a wall or curb, a minimum 1/4 inch key cut shall be made to properly seat the system, providing a smooth transition between areas. The detail cut shall also apply to drain perimeters and expansion joint edges.
d. Cracks and joints (non-moving) greater than 1/8 inch wide are to be chiseled or chipped-out and repaired per manufacturer's recommendations.

5. At spalled or worn areas, mechanically remove loose or delaminated concrete to a sound concrete and patch per manufactures recommendations.

3.3 APPLICATION

A. General

1. The system shall be applied in seven distinct steps as listed below:
   a. Substrate preparation
   b. Priming
   c. First broadcast coat application with first aggregate broadcast
   d. Second broadcast coat with second aggregate broadcast
   e. Grout coat application, sand floor (if required)
   f. First topcoat application
   g. Second topcoat application
2. Immediately prior to the application of any component of the system, the surface shall be dry and any remaining dust or loose particles shall be removed using a vacuum or clean, dry, oil-free compressed air.
3. The handling, mixing and addition of components shall be performed in a safe manner to achieve the desired results in accordance with the Manufacturer's recommendations.
4. The system shall follow the contour of the substrate unless pitching or other leveling work has been specified by the Architect.
5. A neat finish with well-defined boundaries and straight edges shall be provided by the Applicator.

B. Primer

1. The primer shall consist of a liquid resin and hardener that is mixed at the ratio of 1 part resin to 4 parts hardener per the manufacturer's instructions.
2. The primer shall be applied by 1/8 inch notched squeegee and back rolled at the rate of 200 sf/gal to yield a dry film thickness of 4 mils.

C. Broadcast Coat

1. The broadcast coat shall be applied as a double broadcast system as specified by the Architect.
2. The broadcast coat shall be comprised of two components, a resin, and hardener as supplied by the Manufacturer and mixed in the ratio of 2 parts resin to 1 part hardener.

3. The resin shall be added to the hardener and thoroughly mixed by suitably approved mechanical means.
4. The broadcast coat shall be applied over horizontal surfaces using “v” notched squeegee and back rolled at the rate of 90-100 sf/gal.
5. Colored quartz aggregate shall be broadcast to excess into the wet material at the rate of 0.5 lbs/sf.
6. Allow material to fully cure. Vacuum, sweep and/or blow to remove all loose aggregate.
7. Apply a second coat of resin with a coverage rate of 90 sf/gal (Q28) or 50 sf/gal (Q11). and broadcast aggregate to excess at the rate of 0.5 lbs/sf.
8. Allow material to fully cure. Vacuum, sweep and/or blow to remove all loose aggregate.

D. Grout Coat
1. The grout coat shall be comprised of liquid components, combined at a ratio of 2 parts resin to 1 part
2. The grout coat shall be squeegee applied with a coverage rate of 90 sf/gal (Q28) or 50 sf/gal (Q11).

hardener by volume and shall be thoroughly blended by mechanical means such as a high speed paddle mixer.

3. The grout coat will be back rolled and cross rolled to provide a uniform texture and finish.

E. Topcoat
1. The topcoat of Armor Top shall be roller applied at the rate of 500 sf/gal to yield a dry film thickness of 3 mils.
2. The topcoat shall be comprised of a liquid resin, hardener and grit that is mixed per the manufacturer’s instructions.
3. The finish floor will have a nominal thickness of 1/8 inch.

3.4 FIELD QUALITY CONTROL

A. Tests, Inspection

1. The following tests shall be conducted by the Applicator:
   a. Temperature
      1. Air, substrate temperatures and, if applicable, dew point.
   b. Coverage Rates
      1. Rates for all layers shall be monitored by checking quantity of material used against the area covered.

3.5 CLEANING AND PROTECTION

A. Cure flooring material in compliance with manufacturer’s directions, taking care to prevent their contamination during stages of application and prior to completion of the curing process.
B. Remove masking. Perform detail cleaning at floor termination, to leave cleanable surface for subsequent work of other sections.

END OF SECTION 09 67 26

SECTION 09 91 00 – PAINTING Interior

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. Painting and finishing of interior and exterior exposed items and surfaces throughout the project, except as otherwise indicated.
2. Surface preparation, priming and coats of paint specified are in addition to shop-priming and surface treatment specified under other sections of the work.
3. Field painting of exposed bare and covered pipes and ducts, and hangers, exposed steel and iron work, and primed metal surfaces of equipment installed under the mechanical and electrical work, except as otherwise noted.

B. "Paint", as used herein, is defined as all coating systems materials, including primers, emulsions, enamels, stains, sealers and fillers, and other applied materials whether used as prime, intermediate or finish coats.

C. Paint all exposed surfaces except where the natural finish of the material is specifically noted as a surface not to be painted. Where items or surfaces are not specifically mentioned, paint these the same as adjacent similar materials or areas.

D. Paint prefinished metal items such as:

1. Door light stops and moldings.
2. Prefinished door frames.
3. Fire extinguisher cabinets.
4. Radiation covers, cabinet unit heater covers and other "primed" mechanical equipment, electro-statically.

E. Color Coding and Identification: Is specified in respective sections of Divisions 21, through Division 28.

F. Colors: As selected.

1.3 PAINTING NOT INCLUDED:

A. The following categories of work are not included as part of the field-applied finish work, or are included in other sections of these specifications.

1. Shop Priming: Unless otherwise specified, shop priming of ferrous metal items is included under the various sections for structural steel, miscellaneous metal, hollow metal work, and similar items. Also, for fabricated components such as architectural woodwork, wood casework, and shop-fabricated or factory-built mechanical and electrical equipment or accessories.

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2. Pre-Finished Items: Unless otherwise indicated, do not include painting when factory-finishing is specified for such items as (but not limited to) metal toilet enclosures, prefinished partition systems, acoustic materials, architectural woodwork and casework, light fixtures, switchgear and distribution cabinets. Prefinished items to be painted are hereinbefore indicated.
3. Concealed Surfaces: Unless otherwise indicated, painting is not required on surfaces such as walls or ceilings in concealed areas and generally inaccessible areas, foundation spaces, furred areas, utility tunnels, pipe spaces, duct shafts and elevator shafts.
4. Finished Metal Surfaces: Metal surfaces of anodized aluminum, stainless steel, chromium plate, copper, bronze and similar finished materials will not require finish painting. (Note: Copper tubing and piping is not a finished metal.)
5. Operating Parts and Labels:

    a. Moving parts of operating units, mechanical and electrical parts, such as valve and damper operators, linkages, sinkages, sensing devices, motor and fan shafts will not require finish painting.
    b. Do not paint over code-required labels, such as Underwriters' Laboratories and Factory Mutual, or equipment identification, performance rating, name, or nomenclature plates. Permanently remove all other labels, prior to painting.

1.4 QUALITY ASSURANCE:

A. Product Data: For information only, submit copies of manufacturer's technical information including paint label analysis and application instructions for each material proposed for use. For each type of product indicated.

    1. Submit a list of manufacturer's products proposed for use.
    2. Upon approval of the list, submit a detailed schedule of each surface to be painted, and include the specific sealer, primer, underbody and finish coats proposed for each such surface.
    3. After approval is granted, submit complete color catalog(s) for color selections.

B. Samples: Submit samples for review of color and texture only. Compliance with all other requirements is the exclusive responsibility of the Trade Contractor. Provide a listing of the material and application for each coat of each finish sample.

C. Maintenance Sample Stock: Provide the Owner with one (1) gallon, air-tight covered, of each applied paint color for future use. Identify each container with manufacturer's name, number and color designation.

D. Submit certification that materials proposed herein conform to the above requirements and to the fire test requirements of ASTM E84, Class “A” - 0-25 Flame Spread.

    1. Flame Spread Rating: Provide materials with ratings in accordance with NFPA #101, "Life Safety Code", 25 or less in exit ways, corridors, stairways, storage rooms or other areas of high hazard; 75 or less elsewhere.

E. VOC Compliance: Provide LOW VOC materials conforming to the State and local regulations as relating to VOC/VOS requirements at the time of application, and as follows:

    1. VOC Compliance: All paints and coatings must comply with Green Seal Testing Program Limits as follows:

        a. Non-Flat Primer / Paint: 150g/L. VOC Limit
        b. Flat Primer / Paint: 50g/L. VOC Limit

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1.5 DELIVERY AND STORAGE:

A. Delivery:

1. Deliver all materials to the job site in original, new and unopened packages and containers bearing manufacturer's name and label, and application instructions thereon.
2. Provide labels on each container with the following information:

a. Name of title of material.
b. Fed. Spec. number, if applicable.
c. Manufacturer's stock number.
d. Manufacturer's name.
e. Contents by volume, for major pigment and vehicle constituents.
f. Thinning instructions.
g. Application instructions.

B. Storage:

1. Provide a secure space for the storage of all paint materials and equipment for the exclusive use of this work, and maintain and leave it free from fire hazards due to improperly stored rags or thinners.

1.6 JOB CONDITIONS:

A. Apply water-base paints when the temperature of surfaces to be painted and the surrounding air temperatures are between 50 degrees F. and 90 degrees F., unless otherwise permitted by the paint manufacturer's printed instructions.

B. Apply solvent-thinned paints when the temperature of surfaces to be painted and the surrounding air temperatures are between 45 degrees F. and 95 degrees F., unless otherwise permitted by the paint manufacturer's printed instructions.

C. Do not apply paint in snow, rain, fog or mist; or when the relative humidity exceeds 85% or to damp or wet surfaces; unless otherwise permitted by the paint manufacturer's printed instructions.

1. Continue painting during inclement weather, if the areas and surfaces to be painted are enclosed and heated within the temperature limits specified by the paint manufacturer during application and drying periods.

PART 2 - PRODUCTS

2.1 COLORS AND FINISHES:

A. Painting, surface treatments and finishes, are indicated in the "schedules" of the contract documents.

B. See Drawings for color schedule for surfaces to be painted.

1. Provide the necessary compatible base color for the selected finish colors. Should color coverage appear to be a problem, notify the Architect prior to base coat application. Sample areas may be required (approximately four areas of four square feet each).
2. Use representative colors when preparing samples for review.

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C. Upon completion of the first coat, notify the Architect for his review and approval. This review and approval procedure may be done on a room by room basis so as not to impede the progress of the work.

D. Color Pigments: Pure, non-fading, applicable types to suit the substrates and service indicated.

1. Lead content in the pigment, if any, is limited to contain not more than 0.06% lead, as lead metal based on the total non-volatile (dry-film) of the paint by weight.

E. Paint Coordination: Provide finish coats, compatible with prime paints used. Review other sections of these specifications in which prime paints are to be provided to ensure compatibility of total coatings system for various substrates. Upon request, furnish information on characteristics of finish materials proposed for use, to ensure compatible prime coats are used. Provide barrier coats over incompatible primers or remove and reprime, as required. Notify the Architect, in writing, of any anticipated problems using specified coating systems with substrates primed by others.

2.2 MATERIAL QUALITY:

A. Provide the best quality grade of the various types of coatings as regularly manufactured by acceptable paint materials manufacturers. Materials not displaying the manufacturer's identification as a standard, best-grade product will not be acceptable.

B. Interior Paint Manufacturers:

1. Sherwin-Williams Co. "Harmony” Coating System as specified.
2. Benjamin Moore Company "Eco-Spec", as specified.
3. Or equivalent products by the following:

a. PPG Industries “Pure Performance” Low VOC line
b. Devoe "Wonder-Pure" Low VOC line

C. Proprietary names, used to designate colors or materials, are not intended to imply that products of the named manufacturers are required to the exclusion of equivalent products of other manufacturers.

D. Provide undercoat paint produced by the same manufacturer as the finish coats. Use only thinners approved by the paint manufacturer, and use only within recommended limits.

2.3 LOW ODOR - LOW VOC COMPLIANT INTERIOR PAINTS

A. Coordinate with Finish Schedule for material and colors required.

B. Concrete Masonry Units:

1st coat - Sherwin-Williams Loxon Block Surfacer
2nd coat - Sherwin-Williams Harmony Interior Latex Eg-Shel B9 Series
3rd coat - Sherwin-Williams Harmony Interior Latex Eg-Shel B9 Series

or;

1st coat- Benjamin Moore Super Craft Latex Block Filler-285
2nd coat - Benjamin Moore Eco Spec Interior Latex Eggshell 223
3rd coat- Benjamin Moore Eco Spec Interior Latex Eggshell 223

C. Gypsum Drywall System (except ceilings):

1st coat - Sherwin-Williams Harmony Interior Latex Primer B11W900
2nd coat - Sherwin-Williams Harmony Interior Latex Eg-Shel B9 Series
3rd coat - Sherwin-Williams Harmony Interior Latex Eg-Shel B9 Series

or;

1st coat- Benjamin Moore Eco Spec Interior Latex Primer Sealer-231
2nd coat - Benjamin Moore Eco Spec Interior Latex Eggshell 223
3rd coat- Benjamin Moore Eco Spec Interior Latex Eggshell 223

D. Ferrous Metals: (for all exposed to view metal, in finished rooms, including grilles, diffusers, piping, ducts, conduit, metal doors and frames and miscellaneous metals. When concealed from view and in mechanical equipment rooms, spot prime, only):

1st coat - Sherwin-Williams DTM Acrylic Primer/Finish
2nd coat - Sherwin-Williams Harmony Interior Latex Eg-Shel B9 Series
3rd coat - Sherwin-Williams Harmony Interior Latex Eg-Shel B9 Series

or;

1st coat - Benjamin Moore M04 Acrylic Metal Primer-M04
2nd coat - Benjamin Moore Eco Spec Interior Latex Eggshell 223
3rd coat- Benjamin Moore Eco Spec Interior Latex Eggshell 223

E. Galvanized/Zinc Coated Metal: (for all exposed to view metal, in finished rooms, including metal decking, ducts, conduit, grilles, diffusers, miscellaneous metals):

Semi-Gloss Finish (4 mils wet, 1.6 mils dry per coat)

1st Coat - S-W ProCryl Universal Primer, B66-310 Series (110 g/L)
2nd Coat - S-W Harmony Low Odor Interior Latex Semi-Gloss, B10 Series (0 VOC)
3rd Coat - S-W Harmony Low Odor Interior Latex Semi-Gloss, B10 Series (0 VOC)

F. Epoxy Systems (Water Base)

Gloss Finish (2.5 - 3 mils dry per coat)

1st Coat: S-W Waterbased Catalyzed Epoxy, B70W211/ B60V15
2nd Coat: S-W Waterbased Catalyzed Epoxy, B70W211/ B60V15
Semi -Gloss Finish (2.5 - 3 mils dry per coat)

1st Coat: S-W Waterbased Catalyzed Epoxy, B70W211/ B60V25
2nd Coat: S-W Waterbased Catalyzed Epoxy, B70W211/ B60V25

PART 3 - EXECUTION

3.1 INSPECTION:

A. Examine the areas and conditions under which painting work is to be applied and do not proceed with the work until unsatisfactory conditions have been corrected.

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B. Starting of painting work will be construed as acceptance of the surfaces and conditions within any particular area.

C. Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions otherwise detrimental to the formation of a durable paint film.

3.2 PREPARATION:

A. New Substrates:

1. General: Perform preparation and cleaning procedures in strict accordance with the paint manufacturer's instructions and as specified, for each particular substrate condition.

a. Remove all hardware, hardware accessories, machined surfaces, plates, lighting fixtures, and similar items in place and not to be finish-painted, or provide surface-applied protection prior to surface preparation and painting operations. Remove, if necessary, for the complete painting of the items and adjacent surfaces. Following completion of painting of each space or area, reinstall the removed items by workmen skilled in the trades involved.
b. Clean surfaces to be painted before applying paint or surface treatments. Remove oil and grease prior to mechanical cleaning. Program the cleaning and painting so that contaminants from the cleaning process will not fall onto wet, newly-painted surfaces.
c. Equipment, factory primed, including but not limited to fire extinguisher cabinets; electric panels, in finished areas; grilles; diffusers; and similar equipment not indicated to be painted "electro-statically" shall be dulled by sanding with #00 sandpaper or other approved material prior to receiving finish coats. Remove all sanding residue with water-moistened rags or other approved method.

2. Ferrous Metals: Clean ferrous surfaces, which are not galvanized or shop-coated, of oil, grease, dirt, loose mill scale and other foreign substances by solvent or mechanical cleaning.

a. Coordinate with Division 4. Determine if liquid cleaning solutions have been removed from surfaces abutting masonry.
b. Wire brush or mechanically sand rust spots to bright metal and spot prime.
c. Touch-up shop-applied prime coats wherever damaged or bare, where required by other sections of these specifications. Clean and touch-up with the same type shop primer.

3. Galvanized Surfaces: Clean free of oil and surface contaminate with an acceptable non-petroleum based solvent.

3.3 MATERIALS PREPARATION:

A. Mix and prepare painting materials in accordance with manufacturer's directions.

B. Store materials not in actual use in tightly covered containers. Maintain containers used in storage, mixing and application of paint in a clean condition, free of foreign materials and residue.

C. Stir materials before application to produce a mixture of uniform density, and stir as required during the application of the materials. Do not stir surface film into the material. Remove the film and if necessary, strain the material before using.

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3.4 APPLICATION:

A. General:

1. Apply paint in accordance with the manufacturer's directions. Use applicators and techniques best suited for the substrate and type of material being applied.

B. Apply primer, intermediate and finish coats to not less than the manufacturer's recommended wet film and dry film thicknesses and spreading rates for each of the various types of materials specified.

1. Verify mil thickness, wet or dry, by use of recommended gauges.

C. Apply additional coats when undercoats, stains or other conditions show through the final coat of paint, until the paint film is of uniform finish, color and appearance. Give special attention to insure that all surfaces, including edges, corners, crevices, welds and exposed fasteners receive a dry film thickness equivalent to that of flat surfaces.

D. Paint surfaces behind movable equipment and furniture the same as similar exposed surfaces. Paint surfaces behind permanently-fixed equipment or furniture with prime coat only before final installation of equipment.

E. Paint interior surfaces of ducts, where visible through registers or grilles, with a flat, non-specular black paint.

F. Paint the back sides of access panels, and removable or hinged covers to match the exposed surfaces.

G. Finish doors on tops, bottoms and side edges the same as the faces, unless otherwise indicated.

H. Sand lightly between each succeeding enamel or varnish coat.

I. Omit the first coat (primer) on metal surfaces which have been shop-primed and touch-up painted, unless otherwise indicated.

J. Scheduling Painting:

1. Apply the first-coat material to surfaces that have been cleaned, pretreated or otherwise prepared for painting as soon as practicable after preparation and before subsequent surface deterioration.
2. Allow sufficient time between successive coatings to permit proper drying. Do not recoat until paint has dried to where it feels firm, does not deform or feel sticky under moderate thumb pressure, and the application of another coat of paint does not cause lifting or loss of adhesion of the undercoat.

K. Minimum Coating Thickness: Apply each material at not less than the manufacturer's recommended spreading rate, to establish a total dry film thickness as indicated or, if not indicated, as recommended by coating manufacturer.

1. Electrical items to be painted include, but are not limited to, the following:

a. Conduit and fittings.
b. Panels.
c. Panel backboards.

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L. Prime Coats: Apply a prime coat of material which is required to be painted or finished, and which has not been prime coated by others.

1. Recoat primed and sealed surfaces where there is evidence of suction spots or unsealed areas in first coat, to assure a finish coat with no burn-through or other defects due to insufficient sealing.
2. Apply prime coat to all surfaces including surfaces indicated to receive other finishes.

M. Pigmented (Opaque) Finishes: Completely cover to provide an opaque, smooth surface of uniform finish, color, appearance and coverage. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness or other surface imperfections will not be acceptable.

N. Transparent (Clear) Finishes: Use multiple coats to produce glass-smooth surface film of even luster. Provide a finish free of laps, cloudiness, color irregularity, runs, brush marks, orange peel, nail holes or other surface imperfections.

1. Provide satin finish for final coats, unless otherwise indicated.

O. Completed Work: Match approved samples for color, texture and coverage. Remove, refinish or repaint work not in compliance with specified requirements.

3.5 CLEAN-UP AND PROTECTION:

A. Clean-up: During the progress of the work, remove from the site all discarded paint materials, rubbish, cans and rags at the end of each work day.

1. Upon completion of painting work, clean window glass and other paint-spattered surfaces. Remove spattered paint by proper methods of washing and scraping, using care not to scratch or otherwise damage finished surfaces.

B. Protection: Protect work of other trades, whether to be painted or not, against damage by painting and finishing work. Correct any damage by cleaning, repairing or replacing, and repainting, as acceptable to the Architect.

1. Provide "Wet Paint" signs as required to protect newly-painted finishes. Remove temporary protective wrappings provided by others for protection of their work, after completion of painting operations.
2. At the completion of work of other trades, touch-up and restore all damaged or defaced painted surfaces.

END OF SECTION 09 91 00

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SECTION 10 21 10 - TOILET PARTITIONS

PART 1 - GENERAL

SECTION INCLUDES

Solid Color Reinforced Composite (SCRC) Substrate: (Bobrick Sierra Series)

1.1 Toilet partitions.
1.2 Urinal privacy screens.

RELATED SECTIONS

Section 05500 - Metal Fabrications, coordination with overhead supports; steel beams above finished ceiling to secure ceiling hung and floor-to-ceiling stiles.

Section 06100 - Rough Carpentry, coordination with blocking in walls to secure panels, wall posts and stiles.

Section 09200 - Plaster and Gypsum Board, coordination with blocking.

Section 09310 - Tiling, coordination with layout and installation.

Section 09510 - Ceilings, coordination with layout and installation.

Section 10810 - Washroom Accessories, for accessories.

SUBMITTALS

Submit under provisions of Section 102110.

Product Data: Manufacturer's data sheets on each product to be used, including:

1.3 Preparation instructions and recommendations.
1.4 Storage and handling requirements and recommendations.
1.5 Installation methods.

USA Certificate of Origin: Manufacturer shall supply with first submittal, an example of their Certificate of Origin declaring toilet compartments are wholly manufactured and assembled specifically in the United States, including city and state locations. A notarized Certificate of Origin shall be provided with closeout documents.

Shop Drawings: Submit manufacturer's shop drawings for each product specified, including the following:

1.6 Plans, elevations, details of construction and attachment to adjacent construction.
1.7 Show anchorage locations and accessory items.
1.8 Verify dimensions with field measurements prior to final production of toilet compartments.

Selection Samples: For each finish product specified, two complete sets of color chips representing manufacturer's full range of available colors and patterns.

Verification Samples: For each finish product specified, two samples, minimum size 6 inches (150 mm) square representing actual product, color, and patterns.

QUALITY ASSURANCE

Manufacturer Qualifications: Minimum 10 year experience manufacturing similar products.s

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Installer Qualifications: Minimum 2 year experience installing similar products.

Single Source Requirements: To the greatest extent possible provide products from a single manufacturer.

Accessibility Requirements: Comply with requirements applicable in the jurisdiction of the project, including but not limited to ADA and ICC/ANSI A117.1 requirements as applicable.

PRE-INSTALLATION MEETINGS

Convene minimum two weeks prior to starting work of this section.

DELIVERY, STORAGE, AND HANDLING

Deliver and store products in manufacturer's unopened packaging bearing the brand name and manufacturer's identification until ready for installation.

Handling: Handle materials to avoid damage.

PROJECT CONDITIONS

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 recommended limits.

SEQUENCING

Ensure that products of this section are supplied to affected trades in time to prevent interruption of construction progress.

WARRANTY

Manufacturer's Warranty (SierraSeries): Manufacturer's standard 25 year limited warranty for panels, doors, and stiles against breakage, corrosion, delamination, and defects in factory workmanship. Manufacturer's standard 1 year guarantee against defects in material and workmanship for stainless steel door hardware and mounting brackets.

PART 2 - PRODUCTS

MANUFACTURERS

Acceptable Manufacturer: Bobrick Washroom Equipment, Inc., which is located at: 11611 Hart St. ; North Hollywood, CA 91605-5882; Tel: 818-764-1000; Fax: 818-503-1930; Email: request info (info@bobrick.com); Web: www.bobrick.com

PRODUCT DATA SHEET 0 - Basis of Design Products: Based on the quality and performance requirements of the project, specifications are based solely on the products of Bobrick Washroom Equipment, Inc. www.bobrick.com. Location of manufacturing shall be the United States.

Substitutions: The Architect will consider products of comparable manufacturers as a substitution, pending the Contractor's submission of adequate documentation of the substitution in accordance with procedures in Division 1 of the Project Manual. Documentation shall include a list of five similar projects of equivalent size where products have been installed for a minimum of two years, and manufacturer's certification that products are fabricated in the United States.

Requests for substitutions will be considered in accordance with provisions of Section 01600.

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SOLID COLOR REINFORCED COMPOSITE (SCRC) SUBSTRATE (SierraSeries)

Solid Color Reinforced Composite (SCRC) Toilet Partitions: Bobrick SierraSeries.

2.1 Design Type:
- A. Standard Height.
  - 1. Door/Panel Height: 58 inches (147 cm).
  - 2. Floor Clearance: 12 inches (30 cm).
- B. Maximum Height.
  - 1. Door/Panel Height: 72 inches (183 cm).
  - 2. Floor Clearance: 4 inches (10 cm).

2.2 Gap-Free interlocking design.

2.3 Mounting:
- A. Floor-mounted.
  - 1. Stile Standard Height: 70 inches (178 cm).
  - 2. Stile Maximum Height: 76-5/16 inches (198 cm).
- B. Floor-mounted, overhead-braced with satin finish, extruded anodized aluminum headrails, 0.065 inch (1.65 mm) thick with anti-grip profile.
  - 1. Stile Standard Height: 70 inches (178 cm).
  - 2. Stile Maximum Height: 83 inches (211 cm).
- C. Ceiling-hung.
  - 1. Stile Standard Height: 8'-0" or as required 10'-0" (305 cm) maximum.
  - 2. Stile Maximum Height: 8'-0" or as required 10'-0" (305 cm) maximum.
  - 3.

Solid Color Reinforced Composite (SCRC) Urinal Screens: Bobrick Sierra Series.

2.4 Mounting Configuration:
- A. Floor-to-ceiling.
  - 1. Screen Height: 58 inches (178 cm) with floor clearance: 12 inches (30 cm)
  - 2. Stile Height: As required up to 10'-0" (305 cm) maximum
- B. Post-to-ceiling.
  - 1. Screen Height: 58 inches (178 cm)
  - 2. Floor Clearance: 12 inches (30 cm)
  - 3. Post Height: Up to 10'-0" (305 cm) maximum
- C. Post-to-ceiling maximum privacy.
  - 1. Screen Height: 72 inches (183 cm)
  - 2. Floor Clearance: 4-5/16 inches (11 cm)
  - 3. Post Height: Up to 10'-0" (305 cm) maximum
- D. Wall-hung.
  - 1. Screen Height: 42 inches (107 cm) with 18 inches (46 cm) floor clearance.
  - 2. Screen Height: 48 inches (122 cm) with 12 inches (30 cm) floor clearance at accessible urinal panel.

Materials: Solid color reinforced composite (SCRC) material for stiles, panels, doors, and screens with Bobrick GraffitiOff coating, thermoset and integrally fused into homogenous piece; high density polyethylene (HDPE), high density polypropylene not acceptable.

2.5 Composition: Dyes, organic fibrous material, and polycarbonate/phenolic resins.

2.6 Surface Treatment: Non-ghosting, graffiti resistant surface integrally bonded to core through a manufacturing steps requiring thermal and mechanical pressure.

2.7 Edges: Same color as the surface.

2.8 Color:
- A. As selected by Architect from manufacturer's standard SierraSeries range.

B. As indicated on Drawings.
C. SC01 Golden Khaki.
D. SC02 Desert Beige.
E. SC03 Terra Cotta.

2.9 Acceptable SCRC Products: Or manufacturer approved equal.
A. Ultimate Corian System by Shower Shapes.
B. WilsonArt Gibraltar Material.
C. WilsonArt EarthStone Material.

Performance Requirements:
2.10 Graffiti Resistance (ASTM D 6578): Passed cleanability test; 5 staining agents.
2.11 Scratch Resistance (ASTM D 2197): Maximum load value exceeds 10 kilograms.
2.12 Impact Resistance (ASTM D 2794): Maximum impact force exceeds 30 inch-pounds.
2.13 Smoke Developed Index (ASTM E 84): Less than 450.
2.14 Flame Spread Index (ASTM E 84): Less than 75.
2.15 National Fire Protection Association/International Building Code Interior Wall and Ceiling Finish: Class B.
2.16 Uniform Building Code: Class II.

Finished Thickness:
2.17 Stiles and Doors: 3/4 inch (19 mm).
2.18 Panels and Screens: 1/2 inch (13 mm).

Stiles: Floor-anchored stiles furnished with expansion shields and threaded rods.
2.19 Leveling Devices: 7 gauge, 3/16 inches (5 mm) thick, corrosion-resistant, chromate-treated, double zinc-plated steel angle leveling bar bolted to stile; furnished with 3/8 inch (10 mm) diameter threaded rods, hex nuts, lock washers, flat washers, spacer sleeves, expansion anchors, and shoe retainers.
2.20 Stile Shoes: One-piece, 22 gauge (0.8 mm), 18-8, Type 304 stainless steel, 4 inch (102 mm) height; tops with 90 degree return to stile. One-piece shoe capable of adapting to 3/4 inch (19 mm) or 1 inch (25 mm) stile thickness and capable of being fastened (by clip) to stiles starting at wall line.

Wall Posts: Pre-drilled for door hardware, 18-8, Type 304, 16 gauge (1.6 mm) stainless steel with satin finish; 1 inch (25 mm) x 1-1/2 inches (38 mm) x 58 inches high (1473 mm).

Anchors: Expansion shields and threaded rods at floor connections as applicable. Threaded rods secured to supports above ceiling as applicable. Supports above ceiling furnished and installed as Work of Section 055000.

Hardware: Chrome-plated "Zamak", aluminum, extruded plastic hardware not acceptable.
2.21 Compliance: Operating force of less than 5 lb (2.25 kg).
2.22 Emergency Access: Hinges, latch allow door to be lifted over keeper from outside compartment on inswing doors.
2.23 Materials: 18-8, Type 304, heavy-gauge stainless steel with satin finish.
2.24 Doorstops: Prevents inswinging doors from swinging out beyond stile; on outswing doors, doorstop prevents door from swinging in beyond stile.
2.25 Fastening: Hardware secured to door and stile by through-bolted, theft-resistant, pin-in-head Torx stainless steel machine screws into factory-installed, threaded brass inserts. Fasteners secured directly into core not acceptable.
A. Threaded Brass Inserts: Factory-installed; withstand direct pull force exceeding

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1500 lb (680 kg) per insert.

2.26 Clothes Hooks: Projecting no more than 1-1/8 inch (29 mm) from face of door.

2.27 Door Hardware Type:

A. Standard, commercial hardware.

1. Latching: Track of door latch prevents inswing doors from swinging out beyond stile; on outswing doors, door keeper prevents door from swinging in beyond stile; 16 gauge (1.6 mm) sliding door latch, 14 gauge (2 mm) keeper.
2. Hinges: Balanced, with field-adjustable cam to permit door to be fully closed or partially open when compartment is unoccupied.
3. Locking: Door locked from inside by sliding door latch into keeper.

B. Institutional Hardware

1. Latching: 14 gauge (2 mm) sliding door latch, 11 gauge (3.2 mm) keeper; latch slides on a shock-resistant nylon track.
2. Hinges: 16 gauge (1.6 mm) stainless steel, self-closing, 3 section hinges.

2.28 Fittings:

A. Standard, commercial hardware.

1. Mounting Brackets: Mounted inside compartment; exposed brackets on exterior of compartment not acceptable with the exception of outswing doors.

B. Institutional Hardware

1. Mounting Brackets: 18 gauge (1.2 mm) stainless steel and extend full height of panel.
2. U-Channels: Secure panels to stiles.
3. Angle Brackets: Secure stiles-to-walls and panels to walls.

PART 3 - PRODUCTS

PREPARATION

Prepare substrates including but not limited to blocking and supports in walls and ceilings at points of attachment using methods recommended by the manufacturer for achieving the best result for the substrates under the project conditions.

3.1 Inspect areas scheduled to receive compartments for correct dimensions, plumbness of walls, and soundness of surfaces that would affect installation of mounting brackets.

3.2 Verify spacing of plumbing fixtures to assure compatibility with installation of compartments.

If preparation is the responsibility of another installer, notify Architect in writing of deviations from manufacturer's recommended installation tolerances and conditions.

Do not proceed with installation until substrates have been properly prepared with blocking and supports in walls and ceilings at points of attachment and deviations from manufacturer's recommended tolerances are corrected. Commencement of installation constitutes acceptance of conditions.

INSTALLATION

Install products in strict compliance with manufacturer's written instructions and recommendations, including the following:

3.3 Verify blocking and supports in walls and ceilings has been installed properly at points of attachment.

3.4 Verify location does not interfere with door swings or use of fixtures.

3.5 Use fasteners and anchors suitable for substrate and project conditions

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3.6 Install units rigid, straight, plumb, and level.
3.7 Conceal evidence of drilling, cutting, and fitting to room finish.
3.8 Test for proper operation.

ADJUSTING, CLEANING AND PROTECTION

Adjust hardware for proper operation after installation. Set hinge cam on in-swinging doors to hold doors open when unlatched. Set hinge cam on out-swinging doors to hold unlatched doors in closed position.

Touch-up, repair or replace damaged products.

Clean exposed surfaces of compartments, hardware, and fittings.

END OF SECTION

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SECTION 10 28 00 - TOILET ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes: Each type of toilet accessory is shown on the drawings and/ or in the specification.

1.3 QUALITY ASSURANCE:

A. Inserts and Anchorages:

1. Furnish inserts and anchoring devices which must be set in concrete or built into masonry for the installation of toilet accessories. Coordinate delivery with other work to avoid delay.
2. See concrete and masonry sections of these specifications for installation of inserts and anchorage devices.

B. Products:

1. The Basis of Design is Bobrick Washroom Equipment, Inc.
2. Provide products of the same manufacturer for each type of accessory unit and for units exposed in the same areas.
3. Stamped names or labels on exposed faces of units will not be permitted.
4. Provide locks for all dispensing units, with the same keying for each type of accessory units in the project wherever possible. Furnish two keys for each lock.

1.4 SUBMITTALS:

A. Manufacturer's Data: For information only, submit copies of manufacturer's technical data and installation instructions for each toilet accessory.

B. Samples: When requested, submit full-size samples of units for review of design and operation. Acceptable samples will be returned and may be used in the work. Compliance with all other requirements is the exclusive responsibility of the Contractor.

C. Setting Drawings: Provide setting drawings, templates, instructions and directions for installation of anchorage devices in other work.

PART 2 - PRODUCTS

2.1 MATERIALS:

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A. Stainless Steel: AISI, Type 302/304, with polished No. 4 finish, unless otherwise indicated.

B. Brass: Cast or forged quality alloy, FS WW-P-541.

C. Sheet Steel: Cold rolled, commercial quality, ASTM A 366. Surface preparation and metal pretreatment as required for applied finish.

D. Galvanized Steel Sheet: ASTM A 527, G60.

E. Chromium Plating: Nickel and chromium electro-deposited on metal, ASTM B 456, Type SC 2.

F. Baked Enamel Finish: Factory-applied, gloss white, baked acrylic enamel coating.

G. Mirror Glass: ASTM C1036, Class 1, Quality q1, 1/4" thick, with silver coating, copper protective coating, and non-metallic paint coating.

H. Galvanized Steel Mounting Devices: ASTM A 386, hot-dip galvanized after fabrication.

2.2 ACCESSORY SCHEDULE:

A. Include the following accessories:

1. Surface mounted ADA Toilet Tissue Holder B-265; each toilet room
2. Surface mounted ADA Soap Dispenser B-40; each toilet room and break room
3. Surface mounted ADA Paper Towel holder/ trash receptacle B-43949; each toilet room
4. Surface mounted ADA Paper Towel Dispenser B-262; break room
5. Metal Framed Mirrors B-165 1824
6. ADA Grab Bars; lengths as indicated on the drawings
7. Robe Hooks; each toilet room door

PART 3 - EXECUTION

3.1 INSPECTION:

A. Examine the areas and conditions under which toilet accessories are to be installed and do not proceed with the work until unsatisfactory conditions have been corrected.

3.2 INSTALLATION:

A. Use concealed fastenings.

B. Provide anchors, bolts and other necessary anchorages, and attach accessories securely to walls and partitions in locations as shown.

1. Install grab bars so as to sustain a dead weight of 250 pounds for five minutes.

C. Install concealed mounting devices and fasteners fabricated of the same material as the accessories, or of galvanized steel, as recommended by manufacturer.

D. Install exposed mounting devices and fasteners finished to match the accessories.

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E. In public spaces, provide theft-resistant fasteners for all accessory mountings.

F. Secure toilet room accessories in accordance with the manufacturer's instructions for each item and each type of substrate construction.

END OF SECTION 10 28 00

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SECTION 105113 - METAL LOCKERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes: Standard wardrobe lockers.

1.3 RELATED WORK UNDER OTHER SECTIONS:

A. Wood sleepers - Division 06.

1.4 QUALITY ASSURANCE:

A. Provide each type of metal lockers as a complete unit produced by a single manufacturer, including necessary mounting accessories, fittings, and fastenings.

B. Manufacturer: Provide metal wardrobe lockers manufactured by one of the following:

1. Interior Steel Equipment Company
2. Lyon Metal Products
3. Wilson Metal Products
4. Penco Products
5. Republic Steel Corp.
6. ASI Lockers

C. Color: Provide locker units in color(s) as selected from manufacturer's standards.

1. Unless otherwise indicated, non-exposed surfaces may be manufacturer's standard neutral color as selected by Architect.

1.5 SUBMITTALS:

A. Product Data: For information only, submit copies of manufacturer's technical data and installation instructions for the metal locker units.

B. Samples: Submit samples, on metal, of each color and finish that are required for lockers. Review will be for color and texture only. Compliance with all other requirements is the exclusive responsibility of the Contractor.

C. Shop Drawings: Submit shop drawings for metal lockers, verifying dimensions affecting locker installations. Show lockers in detail, method of installation, fillers, trim, base and accessories. Include locker numbering sequence information.

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1.6 PRODUCT DELIVERY, STORAGE AND HANDLING:

A. Do not deliver metal lockers until building is ready for their installation. Protect from damage during delivery, handling, storage, and installation.

PART 2 - PRODUCTS

2.1 MATERIALS:

A. Sheet Steel: Cold-rolled steel for doors and door frames. Cold-rolled steel or annealed, specially treated steel for other parts. All steel free from buckle, scale, and surface imperfections.

B. Fasteners: Cadmium, zinc, or nickel plated steel. Exposed bolt heads, slotless type. Provide self-locking nuts or lock washers for nuts on moving parts, or otherwise prevent loosening of nuts. Do not expose bolts or rivet heads on fronts of lockers or frames.

C. Equipment: Furnish hooks and hang rods of cadmium-plated steel or cast aluminum.

2.2 WARDROBE LOCKERS:

A. Frames: Minimum 16 gage channels or 12 gage angles, with corners electrically welded to form a rigid one-piece structure. Form door stops at vertical members.

1. Extend vertical members to floor to form legs where shown.

B. Backs and Sides: Minimum 24 gage steel. Flange backs on vertical edges, and sides where they intermember with backs, making double-flanged rear corners.

1. Exposed ends of non-recessed lockers; minimum 16 gage steel.

C. Tops, Bottoms and Shelves: Minimum 24 gage steel, flanged edges.

D. Doors: One-piece, minimum 16 gage sheet steel, flanged at all edges. Construct doors to prevent springing when opening or closing. Fabricate doors to swing 180 degrees unless otherwise indicated.

1. Provide extra bracing or reinforcing on inside of doors over 15" wide.
2. Provide stamped louvered vents in door faces, as follows:

a. For single person lockers, not less than 6 louver openings top and bottom.

E. Door Hinges: Heavy-duty, not less than 0.050" thick steel, full-loop, 5-knuckle, tight pin, 2" high. Weld hinges to inside of frame and secure to door with not less than two factory-installed fasteners, completely concealed and tamperproof when locker door is closed.

1. Provide at least 3 hinges for each door 42" high and over, and at least two hinges for each door less than 42" high.

F. Latching: Stainless steel recessed pocket latch with padlock capability

1. Three-point latching for single person lockers.

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2.3 LOCKER ACCESSORIES:

A. Locking: Fabricate lockers to receive the following locking devices.

1. Padlock: Provided by Owner.

B. Equipment: Furnish each locker with the following accessories.

1. Single person Units: One double-prong ceiling hook, three single-prong wall hooks and shelf.
2. Lockers 18” wide x 18" deep x 72” high.

C. Number Plates: Manufacturer's standard etched, embossed, or stamped, non-ferrous metal number plates with numerals not less than 3/8" high. Number the lockers in sequence as directed. Attach plates to each locker door, near top, centered, with at least two fasteners of the same finish as number plate.

D. Metal Base: Minimum 20 gage cold-rolled steel, fabricated to enclose base of lockers without additional fastening devices. Flange bottoms inward 3/4" for stiffening. Factory-finish metal base to match lockers.

E. Sloping Tops: Not less than 20 gage sheet steel, approximately 25 degrees pitch, in as long lengths as practicable. Provide closures at ends. Finish to match lockers, unless otherwise indicated.

F. Trim: Provide trim at jambs and head of recessed lockers, consisting of 18 gage minimum cold-rolled steel, 2" or 3" wide as necessary. Factory-finish trim to match lockers. Secure trim to lockers with concealed fastening clips.

G. Construction: Fabricate lockers square, rigid, and without warp, with metal faces flat and free of dents or distortion. Make all exposed metal edges safe to the touch. Weld frames together. Weld, bolt or rivet other joints and connections as standard with manufacturer. Grind exposed welds flush.

H. Finishing: Chemically pretreat metal with degreasing and phosphatizing process. Apply baked-on enamel finish to all surfaces, exposed and concealed, except plates and non-ferrous metal.

PART 3 - EXECUTION

3.1 INSPECTION:

A. Examine the areas and conditions under which metal wardrobe lockers are to be installed and do not proceed with the work until unsatisfactory conditions have been corrected.

3.2 INSTALLER:

A. Install metal lockers, at the locations shown, in accordance with the manufacturer's instructions for a plumb, level, rigid, and flush installation.

B. Space fastenings about 48" o.c. and apply through back-up reinforcing plates where necessary to prevent metal distortion. Conceal all fasteners.

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C. Install trim, metal base, and sloping top units, where indicated, to provide a flush, hairline joint against adjacent surfaces. Install with concealed fasteners.

D. Touch-up marred finishes, or replace if not acceptable to the Architect. Use only materials and finishes as recommended or furnished by the locker manufacturer.

E. Adjust doors and latches to operate easily without bind. Verify satisfactory operation of integral locking devices.

F. Where required, provide metal filler panels for closure to adjacent surfaces, factory-finished to match lockers.

END OF SECTION 105113

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SECTION 21 00 00 – FIRE PROTECTION

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS AND REFERENCES

A. Include “General Requirements” and applicable parts of Division 1 as part of this section.

B. Examine all other sections of the Specifications for requirements which affect work under this Section whether or not such work is specifically mentioned in this section. Where paragraphs of this section conflict with similar paragraphs of Division 1, requirements of this section shall prevail.

C. Coordinate work with that of all other trades affecting, or affected by work of this section. Cooperate with such trades to assure the steady progress of all work under the Contract.

D. The Subcontractor shall be responsible for filing all documents, payment of all fees, and securing of all inspections and approvals necessary for the work of this section.

E. The Fire Protection Subcontractor shall carry in the Bid Price all Utility Company and Municipal back charges for all materials furnished and work performed by them in conjunction with this Contract and pay same to the respective agency upon demand. The Fire Protection Subcontractor shall not be entitled to additional compensation after the submittal of his bid price should he fail, for any reason, to obtain the total back charge costs to be incurred by the local utility companies or municipal agencies.

1.2 DEFINITIONS

A. As used in this section, “provide,” means “furnish and install”, and “POS” means “Provided Under Other Sections”.

B. As used in the Drawings and Specifications for Fire Protection work, certain non-technical words shall be understood to have specific meanings as follows, regardless of indications to the contrary in the General Conditions of other documents governing the Fire Protection work.

1. “Furnish” means: Purchase and deliver to the project site complete with every necessary appurtenance and support all as part of the Fire Protection work. Purchasing shall include payment of all sales taxes and other surcharges as may be required to assure that purchased item(s) are free of all liens, claims, or encumbrances.

2. “Install” means: Unload at the delivery point at the site and perform every operation necessary to establish secure mounting and correct operation at the proper location in the project, all as part of the Fire Protection work.

3. “Provide” means: “Furnish” and “Install”.

4. “New” means: Manufactured within the past two (2) years and never before used.

C. Except where modified by a specific notation to the contrary, it shall be understood that the indication and/or description of any fire protection item in the Drawings or Specifications for Fire Protection work carries with it the instruction to furnish, install and connect the item as part of the Fire Protection work, regardless of whether or not this instruction is explicitly stated.

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D. It shall be understood that the Specifications and Drawings for Fire Protection work are complimentary and are to be taken together for a complete interpretation of the Fire Protection work.

1.3 SCOPE

A. Perform work and provide material and equipment as shown on Drawings and as specified or indicated in this Section of the Specifications. Completely coordinate work of this Section with work of other trades and provide a complete and fully functional installation.

1. Wet pipe sprinkler system and all components.
2. Sprinkler heads, piping, fittings, hangers and valves.
3. Preparation of complete and detailed Shop Drawings in accordance with NFPA No. 13.
4. Preparation of complete and detailed Working Plans.
5. Submitting Drawings and obtaining necessary approvals, permits and certificates.
6. Tests.
7. Securing hydrant flow test data reports.
8. Hydraulic calculations.
9. Miscellaneous steel support.
10. Assisting the Owner in preparing a fire protection impairment plan.
11. Cutting, patching, firestopping and pipe sleeves.

B. Drawings and Specifications form complimentary requirements; provide work specified and not shown, and work shown and not specified as though explicitly required by both. Although work is not specifically shown or specified, provide supplementary or miscellaneous items, appurtenances, devices and materials obviously necessary for a sound, secure and complete installation.

C. Give notices, file plans, obtain permits and licenses, pay fees and back charges, and obtain necessary approvals from Authorities Having Jurisdiction as required to perform work in accordance with all legal requirements and with Specifications, Drawings, Addenda and Change Orders, all of which are part of Contract Documents.

D. Before submitting bid, visit and carefully examine site to identify existing conditions and difficulties that will affect work of this Section. No extra payment will be allowed for additional work caused by unfamiliarity with site conditions that are visible or readily construed by experienced observer.

E. Before starting work in a particular area of the project, visit site and examine conditions under which work must be performed including preparatory work done under other Sections or Contracts or by Owner. Report conditions that might affect work adversely in writing through Contractor to Architect. Do not proceed with work until defects have been corrected and conditions are satisfactory. Commencement of work shall be construed as complete acceptance of existing and preparatory work.

1.4 RELATED WORK UNDER OTHER SECTIONS

A. The following items are not included in this section and will be performed under the designated sections.

1. Temporary Facilities.
2. Earthwork: Excavation and backfill.
3. Concrete:
   a. Equipment foundations.
   b. Housekeeping pads.
   c. Rebar for items “a, and b” above.

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4. Masonry: All openings in masonry walls.
5. Waterproofing, Dampproofing and Caulking.
6. Roofing and Flashing.
7. Painting: All painting.
8. Finished Carpentry and Millwork.
9. Steel Doors and Frames.
10. Finished Hardware.
11. Elevators and Lifts.
12. Electrical.
13. Plumbing.
14. HVAC.
15. Kitchen equipment.
16. Electric power wiring for all equipment.
17. Fire alarm system and controls.
18. Utilities beyond 10'-0" from the building.
19. Installation of access panels.
20. Electric heat tracing.
21. Concrete basins and pits.

1.5 REGULATORY REQUIREMENTS

A. Comply with all applicable Federal and State laws, and all Local Codes, By-laws and Ordinances.

B. Where provisions of the Contract Documents conflict with any codes, rules or regulations, the latter shall govern. Where the contract requirements are in excess of applicable codes, rules or regulations, the contract provisions shall govern unless the Architect rules otherwise.

C. Request inspections from Authorities Having Jurisdiction, and obtain all permits and pay for all fees and inspection certificates as applicable and/or required. All permits and certificates shall be turned over to the Owners at the completion of the work. Copies of permits shall be given to the resident engineer prior to the start of work.

D. Unless otherwise specified or indicated, materials and workmanship and equipment performance shall conform with the adapted by the State edition of the following standards, codes, Specifications, requirements and regulations:

1. State Building Code.
2. National Electric Code (NEC).
3. Environmental Protection Agency (EPA).
4. Department of Environmental Protection (DEP).
5. Local Ordinances, Regulations of the City of Warwick.
6. National Fire Protection Association (NFPA).
7. Owner's Insurance Underwriters.
8. American National Standards Institute (ANSI).
9. American Society of Mechanical Engineers (ASME).
10. American Society of Testing and Materials (ASTM).
11. American Welding Society (AWS).
12. Commercial Standards, U.S. Department of Commerce (CS).
13. Factory Mutual (FM).
14. Industrial Risk Insurers (IRI).
15. National Electrical Manufacturers Association (NEMA).
16. Underwriter's Laboratories, Inc. (UL).
17. U.S. Department of Health and Human Services, Guidelines for Construction and Equipment for Hospital and Medical Facilities.
18. American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE).

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19. Manufacturers Standardization Society of the Valve and Fittings Industry (MSS).
20. Architectural Access Board (AAB).
21. Americans with Disabilities Act (ADA).

E. All Fire Protection work shall meet or exceed any other State and Local Codes and/or Authorities Having Jurisdiction including all other standards indicated herein.

1.6 SUBMITTALS

A. This paragraph shall supplement Division 1.

B. Definitions:

1. Shop Drawings: Scaled detailed working Drawings (system layout) and equipment Specifications (cut sheets) indicating all information in accordance with requirements of the applicable NFPA Standards for the specific fire protection systems to be installed in accordance with the Registered Professional Engineer's plans and Specifications.

2. Coordination Drawings: Detailed, large-scale layout Shop Drawings showing HVAC, Electrical, Plumbing and Fire Protection work superimposed to identify conflicts and ensure inter-coordination of Mechanical, Electrical, Architectural, Structural and other work.

C. Submittals, Procedures and Format:

1. Review submittal packages for compliance with Contract Documents and then submit to Architect for review. Submit transparency and two (2) blue or black-line reproductions of each Shop Drawing larger than 8-1/2" x 11". Submit eight (8) sets of each smaller shop drawing. After review, transparency original of each large Shop Drawing and six (6) sets of each small shop drawing will be returned with reviewer's marks. Electronically submitted shop drawings are acceptable.

2. Each Shop Drawing shall indicate in title block, and each Product Data package shall indicate on cover sheet, the following information:
   a. Title.
   b. Name and location of project.
   c. Names of Architect, Engineer, Contractor and Subcontractor(s).
   d. Names of Manufacturer, Supplier, Vendor, etc.
   e. Date of submittal.
   f. Whether original submittal or resubmitted.
   g. Contractors' license number and expiration date.

3. Shop Drawings showing manufacturer's product data shall contain detailed dimensional Drawings, accurate and complete description of materials of construction, manufacturer's published performance characteristics and capacity ratings (performance data alone is not acceptable), electrical requirements and wiring diagrams.

D. Acceptable Manufacturers:

1. The Fire Protection design for this project is based on the single manufacturer listed in the specification, schedule or shown on the Drawings. In these Specifications certain "Alternate Manufacturers" are listed as being acceptable. These are acceptable only if, as a minimum, they:
   a. Meet all performance criteria listed in the schedules and outlined in the Specifications.
   b. Have identical operating characteristics to those called for in the Specifications.

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c. Fit within the available space it was designed for, including space for maintenance and component removal, with no modifications to either the space or the product. Clearances to walls, ceilings and other equipment will be at least equal to those shown on the Contract Documents. The fact that a manufacturer's name appears as acceptable shall not be taken to mean the Architect has determined that the manufacturer's products will fit within the available space. This determination is solely the responsibility of the Contractor.
d. For equipment mounted in areas where structural matters are a consideration, the products must have a weight no greater than the product listed in the schedules or Specifications.
e. Products must adhere to all architectural considerations including, but not limited to, being the same size and of the same physical appearance as scheduled or specified products.

E. Substitutions: Substitution of products by manufacturers other than those listed shall only be done in accordance with subparagraph "F" "Substitutions and Deviations".

F. Substitutions and Deviations:

1. Deviations from the Contract Documents and the substitution of materials or equipment relative to the "Acceptable Manufacturers" (referred to above) shall be requested individually in writing whether deviations result from field conditions, standard shop practice, or other cause. Submit letter with transmittal of Shop Drawings which flags the substitution or deviation to the attention of the Architect. The letter shall describe changes in the system shown and physical characteristics (connections to adjacent materials, electrical services, service access requirements, and other characteristics), and differences in operating characteristics.

2. Without letters flagging the substitution or deviation to the Architect, it is possible that the Architect may not notice such substitution or deviation or may not realize its ramifications. Therefore, if such letters are not submitted to the Architect, the Contractor shall hold the Architect and his consultants harmless for any and all adverse consequences resulting from the deviations being implemented. Adverse consequences shall include, but not be limited to, excessive noise, excessive maintenance, shortened longevity, spatial coordination problems, and inadequate performance versus scheduled design. This shall apply regardless of whether the Architect has reviewed or approved Shop Drawings containing the deviation, and will be strictly enforced.

3. Do not request substitute materials or equipment unless identical material or equipment has been operated successfully for at least three (3) consecutive years. Such materials and equipment shall be a regular cataloged item shown in the current catalog of the manufacturer. When deviation or substitution is permitted, coordinate fully with related changes to Architectural, Structural, Plumbing, Fire Protection, Mechanical, and other work. Ensure that related changes necessary for coordination of substituted items are made within the Contract Price. Assume full responsibility for safety, operation and performance of the altered system.

4. Substitutions of equipment, systems, etc. requiring approval of local Authorities must comply with such regulations and be filed by the Contractor (should filing be necessary).

5. Consideration will not be given to claims that the substituted item meets the performance requirements with lesser construction. Performance, as delineated in schedules and in the Specifications, shall be interpreted as minimum performance.

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6. Approval of proposed deviations or substitutions, if any, will be made at discretion of Architect.

7. If equipment is proposed for substitution that is not tested and rated according to industry-wide standards, the Architect shall have the right to have performance tests completed, at the Contractor's expense, to confirm the manufacturer's performance claims.

G. Submittal Notations: Submittals will be returned from the Architect marked as illustrated below:

☐ NO EXCEPTION TAKEN	☐ ACCEPTED AS NOTED
☐ NOT ACCEPTED	☐ REVISE AND RESUBMIT

1. Checking is only for general conformance with the design concept of the project and general compliance with the information given in the contract documents. Any action shown is subject to the requirements of the Drawings and Specifications. Contractor is responsible for dimensions which shall be confirmed and correlated at the job site; fabrication process and techniques of construction; coordination of his work with that of all other trades; and the satisfactory performance of his work.

H. Schedule: Incorporated the Shop Drawing review period into the construction schedule so that work is not delayed. Contractor shall assume full responsibility for delays caused by not incorporating the following Shop Drawing review time requirements into his project schedule. Allow at least ten (10) working days, exclusive of transmittal time, for review each time shop a Shop Drawing is submitted or resubmitted with the exception that fifteen (15) working days, exclusive of transmittal time, are required for the following:

1. Coordination Drawings, if required by this Specification.
2. If more than five (5) Shop Drawings of this trade are received in one (1) calendar week.

I. List of Proposed Equipment and Materials: Within four (4) weeks after Award of Contract and before ordering materials or equipment, submit a complete list of proposed materials and equipment and indicate manufacturer's names and addresses. No consideration will be given to partial lists submitted out of sequence.

J. Responsibility:

1. The intent of submittal review is to check for capacity, rating, and certain construction features. Contractor shall ensure that work meets requirements of the Contract Documents regarding information that pertains to fabrication processes or means, methods, techniques, sequences and procedures of construction; and for coordination of work of this and other Sections. Work shall comply with submittals marked "REVIEWED" to extent that they agree with the Contract Documents. Submittal review shall not diminish responsibility under this Contract for dimensional coordination, quantities, installation, wiring, supports and access for service, nor the Shop Drawing errors or deviations from requirements of the Contract Documents. The Architect's noting of some errors while overlooking others will not excuse the Contractor for proceeding in error. Contract Document requirements are not limited, waived, nor superseded in any way by review.

2. Inform Subcontractors, Manufacturers, Suppliers, etc. of scope and limited nature of review process and enforce compliance with the Contract Documents.

K. Material and equipment requiring Shop Drawing Submittals shall include but not be limited to:

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1. Wet pipe sprinkler system components including alarm valves, pipe, fittings, sprinkler heads, pressure gauges, etc.

2. Access panels.

3. Seismic restraints.

4. Sprinklers shall be referred to on drawings and shall be specifically identified by the listed manufacturer's style or series designation. Trade names and abbreviations are not permitted.

1.7 SURVEYS AND MEASUREMENTS

A. Base all required measurements, both horizontal and vertical, on reference points established by the General Contractor and be responsible for the correct laying out of the Fire Protection work. In the event of a discrepancy between actual measurements and those indicated, notify the General Contractor in writing. Do not proceed with the work required until written instructions have been issued by the General Contractor.

1.8 COORDINATION

A. HVAC, Plumbing, Fire Protection, and Electrical Drawings are diagrammatic. They indicate general arrangements of Mechanical and Electrical systems and other work. They do not show all offsets required for coordination nor do they show the exact routings and locations needed to coordinate with Structural and other trades and to meet Architectural requirements.

B. Work shall be performed in cooperation with other trades on the project and so scheduled as to allow speedy and efficient completion of the work.

C. Furnish to other trades advance information on locations and sizes of all frames, boxes, sleeves and openings needed for their work. Furnish information and Shop Drawings necessary to allow trades affected by the work to install their work properly and without delay.

D. In all spaces, prior to installation of visible material and equipment, including access panels, review Architectural Drawings for exact locations and where not definitely indicated, request information from Architect. Where the Fire Protection work shall interfere with the work of other trades, assist in coordinating the space conditions to make satisfactory adjustments before installation. Without extra cost to the Owner, make reasonable modifications to the work as required by normal Structural interferences. Pay the General Contractor for additional openings, or relocating and/or enlarging existing openings through concrete floors, walls, beams and roof required for any work which was not properly coordinated. Maintain maximum headroom at all locations. All piping, duct, conduit, and associated components to be as tight to underside of structure as possible.

E. If any Fire Protection work has been installed before coordination with other trades so as to cause interference with the work of such trades, all necessary adjustments and corrections shall be made by the fire protection trades involved without extra cost to the Owner.

F. Where conflicts or potential conflicts exist and engineering guidance is desired, submit sketch of proposed resolution to Architect for review and approval.

G. Protect all materials and work of other trades from damage which may be caused by the Fire Protection work, and repair all damages without extra cost to the Owner.

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1.9 ELECTRICAL COORDINATION

A. Fire Protection Subcontractor shall furnish and install various electrical items relating to the fire protection equipment and control apparatus. The Electrical Subcontractor shall be required to connect power wiring to this equipment unless noted otherwise.

B. The Fire Protection and Electrical Subcontractors shall coordinate their respective portions of the work, as well as the electrical characteristics of the fire protection equipment.

C. All power wiring and local disconnect switches will be provided by the Electrical Subcontractor for the line voltage power.

D. 120V and above power wiring sources extended and connected to fire protection control panels, transformers and switches shall be the responsibility of the Electrical Subcontractor.

E. Flow and tamper switches shall be connected to the Building's fire alarm system by the Electrical Subcontractor.

1.10 MECHANICAL AND ELECTRICAL COORDINATION DRAWINGS

A. Coordination Drawings:

1. The Sheetmetal Subcontractor shall prepare a complete set of electronic Drawings at a scale not less than 3/8" equals 1'-0", showing structure and other information as needed for coordination. He shall show sheetmetal layout thereon. These will be the Coordination Drawings.

2. The main paths of egress and for equipment removal, from main Mechanical and Electrical rooms must be clearly shown on the Coordination Drawings.

3. Each of the below specialty trades shall add its work to these background Drawings with appropriate elevations and grid dimensions. Specialty trade information is required for fan rooms and mechanical rooms, horizontal exits from duct shafts, crossovers, and for spaces in and above ceilings where congestion of work may occur such as corridors, and even entire floors. Drawings shall indicate horizontal and vertical dimensions, to avoid interference with structural framing, ceilings, partitions, and other services.
   a. Specialty Trades:
      1) Plumbing System.
      2) HVAC Piping and Associated Control System.
      3) Electrical.
      4) Sheet Metal Work.
      5) Sprinkler System.

4. Each specialty trade shall sign and date each electronic Coordination Drawing. Return Drawings to the Sheetmetal Subcontractor, who shall route them sequentially to all specialty trades.

5. Where conflicts occur with placement of materials of various trades, the Sheetmetal Subcontractor will be responsible to coordinate the available space to accommodate all trades. Any resulting adjustments shall be initialed and dated by the specialty trade. The Sheetmetal Subcontractor shall then final date and sign each Coordination Drawing. If he cannot resolve conflicts, the decision of the General Contractor shall be final, subject to the approval of the Architect.

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6. A Subcontractor who fails to promptly review and incorporate his work on the Coordination Drawings shall assume full responsibility of any installation conflicts affecting his work and of any schedule ramifications.

7. Sheetmetal Subcontractor shall make electronic copies of all Coordination Drawings. Fabrication shall not start until such transparencies of completed Drawings are received by the Architect/Engineer and have been reviewed.

8. Review of Coordination Drawings shall not diminish responsibility under this Contract for final coordination of installation and maintenance clearances of all systems and equipment with Architectural, Structural, Mechanical, and Electrical Contractors.

1.11 INSTALLATION REQUIREMENTS

A. The arrangement of all Fire Protection work shown on the Drawings is diagrammatic only and indicates the minimum requirements of the work. Conditions at the building including actual measurements shall determine the details of the installation. All work shall be laid out and installed so as to require the least amount of cutting and patching.

B. Check the Architectural plans and Specifications before ordering any material and equipment. Any discrepancies shall be brought to the attention of the Architect for his determination prior to proceeding with the work.

1.12 TYPICAL DETAILS

A. Typical details where shown on the Drawings shall apply to each and every item of the project where such items are applicable. They are not repeated in full on the Drawings, which in many cases are diagrammatic only, but with the intention that such details shall be incorporated in full. Any alternate method proposed for use by the Contractor shall have the prior approval of the Architect.

1.13 SLEEVES, INSERTS

A. Furnish and install all sleeves, inserts, anchor bolts and similar items to be set into masonry or concrete, as required for Fire Protection work as indicated in Division 01. Internal diameter of sleeve shall be 1/2” larger than the outside diameter of the pipe or insulation covered line passing through it.

1.14 CORING, DRILLING

A. Core, cut and/or drill all holes in walls and floors required for the installation of sleeves and supports for the Fire Protection work as indicated in Division 01.

1.15 FIRE STOPPING, SMOKEPROOFING & WATERPROOFING

A. All cutting, patching, firestopping and waterproofing shall be performed by the Fire Suppression Subcontractor. Refer to Sections 01 73 29 – CUTTING AND PATCHING, 07 00 01 – WATERPROOFING, DAMPPROOFING & CAULKING, and 07 84 13 PENETRATION FIRESTOPPING for project requirements.

1.16 ACCESSIBILITY

A. Install all work such that parts requiring periodic inspection, operation, maintenance and repair are readily accessible.

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B. Furnish all access panels appropriate to particular conditions, to be installed by trades having responsibility for the construction of actual walls, floors or ceilings at required locations.

1.17 SUPPLEMENTARY SUPPORTING STEEL

A. Provide all supplementary (non-structural) steelwork required for mounting or supporting equipment and materials.

B. Steelwork shall be firmly connected to building construction as required. Locations and methods of attachment shall be approved by the Architect.

C. Steelwork shall be of sufficient strength to allow only minimum deflection in conformity with manufacturer's published requirements.

D. All supplementary steelwork shall be installed in a neat and workmanlike manner parallel to floor, wall and ceiling construction: all turns shall be made at forty-five and ninety degrees, and/or as dictated by construction and installation conditions.

E. All manufactured steel parts and fittings shall be galvanized.

1.18 TOOLS AND EQUIPMENT

A. Provide all tools and equipment required for the fabrication and installation of the mechanical and electrical equipment at the site.

1.19 PORTABLE AND DETACHABLE PARTS

A. Contractors shall retain in their possession all portable and/or detachable parts and portions of materials, devices, equipment, etc. necessary for the proper operation and maintenance of the Fire Protection system until final completion of the work, at which time they shall be handed over to the Owners.

1.20 RECORD DRAWINGS, PROJECT CLOSEOUT

A. As the work progresses and for the duration of Contract, maintain a complete and separate set of prints of Contract Drawings at job site at all times. Record work completed and all changes from original Contract Drawings clearly and accurately including work installed as a modification or addition to the original design. Work shall be updated on a weekly basis and shall be made available for review by Architect. Failure to perform this work shall be reason for withholding requisition payments. In addition, take photographs of all concealed equipment in gypsum board ceilings, shafts, and other concealed, inaccessible work. At completion of work, make copies of photographs with written explanation on back. These shall become part of Record Documents.

B. At completion of the work prepare a complete set of electronic Record Drawings showing all systems as actually installed, including all fire alarms and electrical circuitry. The electronic copies will be made available for the Fire Protection Contractor's copying, at his expense, for the Record Drawings. The quantity of electronic copies which are made available shall in no way be interpreted as setting a limit to the number of Drawings necessary to show the required information. The Fire Protection Contractor's professional Draft Person shall transfer changes to electronic copies. Submit sets of prints to Architect for comments as indicated in Division 01 - 01 77 00 CONTRACT CLOSEOUT.

C. The Architect will not certify the accuracy of the Record Drawings. This is the sole responsibility of the Fire Protection and General Contractors.

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D. This trade shall submit the Record Drawings for approval by the Fire and Building Departments in a form acceptable to the departments, when required by the jurisdiction.

E. Record Drawings shall show record condition of details, sections, riser diagrams, control changes and corrections to schedules. Schedules shall show actual manufacturer, make and model numbers of final equipment installation.

1.21 GUARANTEE/WARRANTY

A. Guarantee and 24 hour service.

1. Guarantee Work of this Section in writing for not less than one (1) year following the date of acceptance by the Owner. If the equipment is used for temporary service etc, prior to acceptance by the Owner, the bid price shall include an extended period of warranty covering the one (1) year of occupancy, starting from the date of acceptance by the Owner. The guarantee shall repair or replace defective materials, equipment, workmanship and installation that develop within this period, promptly and to the Architect's satisfaction and correct damage caused in making necessary repairs and replacements under guarantee within Contract Price.

2. In addition to guarantee requirements of Division 1 and of Subparagraph A above, obtain written equipment and material warranties offered in manufacturer's published data without exclusion or limitation, in Owner's name.

3. Upon receipt of notice from the Owner of failure of any part of the systems or equipment during the warranty period, the affected part or parts shall be replaced by this Contractor without any reimbursement.

4. Replace material and equipment that require excessive service during guarantee period as defined and as directed by Architect.

5. Provide 24 hour service beginning on the date the project is accepted by the Owner, whether or not fully occupied, and lasting until the termination of the guarantee period. Service shall be at no cost to the Owner. Service can be provided by this Contractor or a separate service organization. Choice of service organization shall be subject to Architect and Owner approval. Submit name and a phone number that will be answered on a 24 hour basis each day of the week, for the duration of the service.

6. Submit copies of equipment and material warranties to Architect before final payment.

7. At end of guarantee period, transfer manufacturer's equipment and material warranties still in force to Owner.

8. This paragraph shall not be interpreted to limit Owner's rights under applicable codes and laws and under this Contract.

9. Part 2 paragraphs of this Specification may specify warranty requirements that exceed those of this paragraph. Those paragraphs shall govern.

10. Use of systems provided under this Section for temporary services and facilities shall not constitute Final Acceptance of Work by Owner, and shall not initiate the guarantee period.

11. Provide manufacturer's engineering and technical staff at site to analyze and rectify problems that develop during guarantee period immediately. If problems cannot be rectified immediately to Owner's satisfaction then advise the Architect in writing, describe efforts to

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rectify situation, and provide analysis of cause of problem. The Architect and/or Engineer will direct course of action.

1.22 OPERATING, INSTRUCTION AND MAINTENANCE MANUALS

A. Refer to Section 01 70 00 – CONTRACT CLOSEOUT and 01 78 23 – OPERATION AND MAINTENANCE DATA for submittal procedures pertaining to Operating and Maintenance Manuals.

B. Each copy of the approved Operating and Maintenance Manual shall contain copies of approved Shop Drawings, equipment literature, cuts, bulletins, details, equipment and engineering data sheets and typewritten instructions relative to the care and maintenance for the operation of the equipment, all properly indexed. Each manual shall have the following minimum contents:

1. Table of Contents.

2. Introduction:
   a. Explanation of manual and its purpose and use.
   b. Description of systems.
   c. Safety precautions necessary for equipment.
   d. Illustrations, schematics and diagrams.
   e. Installation drawing.

3. Maintenance:
   a. Maintenance and lubricating instructions.
   b. Replacement charts.
   c. Trouble-shooting charts for equipment components.
   d. Testing instructions for each typical component.
   e. Two (2) typed sets of instructions for ordering spare parts. Each set shall include name, price, telephone number and address of where they may be obtained.

4. Manufacturer's Literature: The equipment for which Shop Drawings have been submitted and approved.

1.23 QUALITY ASSURANCE

A. The requirements of the State Building Code and Local regulations establish the minimum acceptable quality of workmanship and materials, and all work shall conform thereto unless more stringent requirements are indicated or specified herein.

B. All work shall comply with the adapted by the State editions of the codes as referenced herein.

C. All grooved joint couplings, fittings, valves, and specialties shall be the products of a single manufacturer. Grooving tools shall be of the same manufacturer as the grooved components.

1. All castings used for coupling housings, fittings, valve bodies, etc., shall be date stamped for quality assurance and traceability.

D. Follow manufacturer's directions for articles furnished, in addition to directions shown on Drawings or specified herein.

E. Protect all work, materials, and equipment from damage during process of work. Replace all damaged or defective work, materials and equipment without additional cost to the Owner.

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F. All equipment and materials for permanent installation shall be the products of recognized manufacturers and shall be new.

G. Equipment and materials shall:

1. Where normally subject to Underwriters Laboratory Inc. listing or labeling services, be so listed and labeled.

2. Be without blemish or defect.

3. By products which will meet with the acceptance of all Authorities Having Jurisdiction over the work. Where such acceptance is contingent upon having the products examined, tested and certified by Underwriters or other recognized testing laboratory, the product shall be so examined, tested and certified.

H. All items of equipment or material of one generic type shall be the product of one manufacturer throughout.

I. For items which are to be installed but not purchased as part of the Fire Protection work, the Fire Protection work shall include:

1. The coordination of their delivery.

2. Their unloading from delivery trucks driven into any point on the property line at grade level.

3. Their safe handling and field storage until the time of permanent placement in the project.

4. The correction of any damage, defacement or corrosion to which they may have been subjected. Replacement, if necessary, shall be coordinated with the Contractor who originally purchased the item.

5. Mounting in place, including the purchase and installation of all dunnage, supporting members, and fastenings, necessary to adapt them to architectural and structural conditions.

J. Items which are to be installed but not purchased as part of the Fire Protection work shall be carefully examined upon delivery to the project. Claims that any of these items have been received in such condition that their installation will require procedures beyond the reasonable scope of the electric work will be considered only if presented in writing within one (1) week of the date of delivery to the project of the items in question. The Fire Protection work includes all procedures, regardless of how extensive, necessary to put into satisfactory operation, all items for which no claims have been submitted as outlined above.

1.24 DELIVERY, STORAGE AND HANDLING

A. All materials for the work of this section shall be delivered, stored and handled so as to preclude damage of any nature. Manufactured materials shall be delivered and stored in their original containers, plainly marked with the products' and manufacturer's name. Materials in broken containers or in packages showing watermarks or other evidence of damage shall not be used and shall be removed from the site.

1.25 STAGING AND SCAFFOLDING

A. Provide staging and scaffolding for all the work of this section complying with Division 1 requirements.

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1.26 EXTRA MATERIALS

A. Furnish extra materials described in following product specification sections that match products installed, are packaged with protective covering for storage, and are identified with labels clearly describing contents.

1.27 PHASING, DEMOLITION AND MAINTAINING EXISTING SERVICES

A. During the execution of the work, required relocation, etc., of existing equipment and systems in the existing building areas where new work is to be installed or new connections are scheduled to be made, shall be performed by the Fire Protection Subcontractor, as required by job conditions and as determined by the Architect in the field, to facilitate the installation of the new system, while demolition, relocation work or new tie ins will be performed. Outages required for construction purposes shall be scheduled for the shortest practical period of time, in coordination with the Owner's designated representative, for specified, mutually agreeable periods of time, after each of which the interruption shall cease and the service shall be restored. This procedure shall be repeated to suit the Owner's working schedule, as many times as required until all work is completed. Any outages of service shall be approved by the Owner, prior to commencing the work. No outages or shutdowns of service shall occur without the written authorization of the Owner prior to commencing the work. Give notice of any scheduled shutdowns, a minimum of two (2) weeks in advance. Owner shall make their best efforts to meet this request without adversely affecting the fire protection service to the existing building.

B. Prior to any deactivation and relocation or demolition work, consult the Drawings and arrange a conference with the Architect and Owner's representative in the field to inspect each of the items to be deactivated, removed or relocated. Care shall be taken to protect all equipment designated to be relocated and reused or to remain in operation and be integrated with the new systems.

C. All deactivation, relocation and temporary tie-ins of fire protection systems and equipment shall be provided by the Fire Protection Subcontractor. All demolition and removal of fire protection systems and equipment designed to be demolished shall be provided by the Fire Protection Subcontractor. Place all demolished fire protection materials except hazardous materials as determined by the Authority having jurisdiction in General Contractor's dumpster. All hazardous materials shall be legally disposed of by the Fire Protection Subcontractor.

D. The Owner reserves the right to inspect the material scheduled for removal and salvage any items he deems usable as spare parts.

E. Phasing:

1. The Fire Protection Subcontractor shall construct the subject project in phases as directed by the Architect to suite the project progress schedule, as well as the completion date of the project.

2. For additional information related to phasing, review the General Conditions and Supplementary Conditions and the Architectural Drawings.

1.28 DESIGN CRITERIA

A. Provide wet-pipe sprinklers in all areas. Provide dry-type sprinkler system in all areas where ambient temperature is 40 deg. F or below.

B. Design sprinkler system according to the following:

1. Sprinkler Occupancy Hazard Classifications as follows:

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a. Building Services Areas: Ordinary Hazard, Group 2.
b. Electrical Equipment Rooms: Ordinary Hazard, Group 1.
c. General Storage Areas: Ordinary Hazard, Group 2.
d. Mechanical Equipment Rooms: Ordinary Hazard, Group 2.
e. Office and Public Areas: Light Hazard.

2. Minimum Density for Automatic Sprinkler Piping Design – as follows:
   a. Light-Hazard Occupancy: 0.10 gpm over 1500-sq. ft. area.
   b. Ordinary-Hazard, Group 1 Occupancy: 0.15 gpm over 1500-sq. ft. area.
   c. Ordinary-Hazard, Group 2 Occupancy: 0.20 gpm over 1500-sq. ft. area.
   d. Special Occupancy Hazard: As determined by Authorities Having Jurisdiction.

3. Maximum Protection Area per Sprinkler – as follows:
   a. Office space: 225 sq. ft.
   b. Future Tenant Space: 168 sq. ft.
   c. Storage Areas: 130 sq. ft.
   d. Mechanical Equipment Rooms: 130 sq. ft.
   e. Electrical Equipment Rooms: 130 sq. ft.

C. Secure water flow test data taken from fire hydrants nearest site. If recent flow test data is not available from city records, make necessary tests as required by NFPA Standard to determine character of water supply.

D. Run piping horizontally and at right angles to walls and ceilings. Center sprinkler heads with respect to ceiling components, such as ceiling grid, lighting fixtures, HVAC diffusers and speakers, as directed by Architect.

E. Add a 10 psi safety factor to hydraulic calculations for a cushion against future pipe main deterioration. Pipe velocity in sprinkler piping shall not exceed 20 FPS.

F. Provide test connections at highest point of main portion of each sprinkler system, with 1” pipe and valve. Test pipe shall be connected to sprinkler pipe at least 1-1/4” in size and shall discharge outside building.

G. Provide sprinklers in all areas except where exempted by code or AHJ.

1.29 FIRE PROTECTION WORKING PLANS

A. Submit working plans to indicate actual sprinkler system and/or combination system piping layout. Working plans shall be signed and sealed by a professional engineer.

B. Seismic restraints: All seismic restraints shall be indicated on working plans including locations and type of plan, details and calculations.

C. Hydraulic calculations shall be signed and sealed by Professional Engineer. Submit working plans and hydraulic calculations to:

1. Architect/Engineer.
2. Insurance Underwriter.
3. Building Department.
4. Fire Department.

D. Submit working plans and hydraulic calculations in one complete package. When it is not possible to submit entire system design in one package due to job conditions, submit plans of

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entire building indicating areas not yet defined. Submit working plans and hydraulic calculations to:

1. Architect/Engineer.
2. Insurance Underwriter.
3. Building Department.
4. Fire Department.

E. Working plans shall be at least 1/8”=1’ scale of sheets of uniform size. Working plans shall show all data required by NFPA No. 13, including but not limited to:

1. Name of Owner and Occupant.
2. Location, including street address.
3. Point of compass.
4. Full height cross section, or schematic diagram, if required for clarity; including ceiling construction and method of protection for nonmetallic piping.
5. Location of partitions.
6. Location of fire walls.
7. Occupancy class of each area or room.
8. Location and size of concealed spaces, closets, attics, and bathrooms.
9. Any small enclosures in which no sprinklers are to be installed.
10. Size of city main in street and whether dead-end or circulating; and, if dead-end, direction and distance to nearest circulating main. City main test results and system elevation relative to test hydrant.
11. Other sources or water supply, with pressure or elevation.
12. Make, type, and nominal orifice size of sprinklers.
13. Temperature rating and location of high-temperature sprinklers.
14. Total area protected by each system on each floor.
15. Number of sprinklers on each riser per floor.
16. Pipe type and schedule of wall thickness.
17. Nominal pipe size and cutting lengths of pipe (or center-to-center dimensions).
    a. Note: Where typical branch lines prevail, it will be necessary to size only one typical line.
18. Location and size of riser nipples.
19. Type of fittings and joints and location of all welds and bends. The Contractor shall specify on drawing any sections to be shop welded and the type of fittings or formations to be used.
20. Type and locations of hangers, sleeves, braces, and methods of securing sprinklers when applicable.
21. All control valves, check valves, drain pipes, and test connections.
22. Make, type, model, and size of alarm valve.
23. Kind and location of alarm bells.
24. Size and location of hose outlets, hand hose, and related equipment.
25. Underground pipe size, length, location, weight, material, point of connection to city main; the type of valves, meters, and valve pits; and the depth that the top of the pipe is laid below grade.
26. Piping provisions for flushing.
27. Where the equipment is to be installed as an addition to an existing system, enough of the existing system indicated on the plans to make all conditions clear.
28. For hydraulic designed systems, the information on the hydraulic data nameplate.
29. A graphic representation of the scale used on all plans.
30. Name and Address of Contractor.
31. Hydraulic reference points shown on the plan shall correspond with comparable reference points on the hydraulic calculation sheets.
32. The minimum rate of water application (density), the design area of water application, in-rack sprinkler demand, and the water required for hose streams both inside and outside.

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33. The total quantity of water and the pressure required noted at a common reference point for each system.
34. Relative elevations of sprinklers, junction points, and supply or reference points.
35. If room design method is used, all unprotected wall openings throughout the floor protected.
36. Calculation of loads for sizing, and details of sway bracing.
37. The setting for pressure-reducing valves.
38. Information about backflow preventers (manufacturer, size, type).

F. Working plans will be subject to (Architect's) (Owner's) final approval. Submit to (Architect) (Owner) after review by other Authorities. If necessary to submit plans to Architect before review by other Authorities, identify Authorities that have not reviewed plans and resubmit for final approval when review by all parties is complete.

G. Sprinkler pipe sizing shall be based on hydraulic calculations.

H. Fire protection contractor shall provide piping layout on measured Drawings. For renovation projects, this shall require Contractor to field survey existing building and prepare reproducible Drawings on which to show building background and all Fire Protection work.

I. Working Plans shall show all hangers and supports from floors, walls, underside of slabs and structural steel members. Where piping cannot be supported from walls or slabs, contractor shall provide additional structural steel bracing to support pipe.

J. Working Plans shall be submitted with the shop drawing cover sheet from Division 01. Any deviations from original plans and Specifications shall be noted. Any hydraulic deviations shall be noted.

1.30 UNIT PRICES

A. The Fire Protection Subcontractor shall list the following unit prices in bid proposal which shall include the complete installation (labor and materials) for each item(s):

1. Cost for addition of pendent head.
2. Cost for addition of sidewall head.
3. Cost for addition of upright head
4. Savings or deduction for eliminating a sprinkler head.

B. Above prices shall include 10 feet of piping, connection, sprinkler heads, fittings, hangers, labor system draining and refill, drawing involvement and any other associated costs for the addition or deletion of a sprinkler head.

PART 2 PRODUCTS

2.1 PIPE AND FITTINGS

A. Piping shall meet applicable ANSI or ASTM standard requirements and shall have manufacturer's name and standard marked on each length. Joints shall meet applicable ANSI or ASTM standards requirements. Where ANSI or ASTM standard does not exist, joints and fittings shall bear UL listing symbol.

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B. General Material Notes:

1. System components shall be rated for the maximum working pressure to which they are exposed, but not less than 175 psig.

2. Pipe, tube valves and fittings shall meet or exceed ASTM/ANSI standards listed in the National Fire Protection Codes and specifically in NFPA-13.

3. All threaded piping and fittings shall conform to thread cuts listed in ANSI/ASME B1.20.1.

4. Welded methods shall comply with all the requirements listed in American Welding Society document D10.9, Levels AR-3.

5. Provide one-piece chrome plates escutcheons for all wall, floor and ceiling pipe penetrations in finished rooms and areas.

2.2 WET PIPE SPRINKLER AND STANDPIPE (175 psi)

Carbon Steel	2” and Smaller	2-1/2” and Larger
Pipe	Welded and seamless black steel pipe conforming to ASTM A53, ASTM A795 or ANSI/ASTM A135, Schedule 40.	Welded and seamless black steel pipe conforming to ASTM A795 or ANSI/ASTM A135, Schedule 10.
Fittings	Cast iron fittings. ANSI/ASME B16.1 and B16.4	Mechanical grooved couplings with ductile iron housing clamps to engage and lock, “C” shaped composition sealing gasket, steel bolts, nuts and Vic plug gasket (pre-tube).
Joints	Thread. Apply joint compound or Teflon tape to male pipe threads on threaded systems.	Weld or roll groove. Welding procedures shall conform to the requirements of AWS D.10.9, level AR3.
Flanges	Flanges shall be plain faced and shall be CI-150 and shall conform to ANSI B.16.5.	Flanges shall be plain faced and shall be CI-150 and shall conform to ANSI B16.5.
Gaskets/Bolts	Gaskets shall be full face rubber 1/8” thick. Bolts and nuts shall conform to ANSI B18.2.1 and B18.2.2, respectively.	Gaskets shall be full face rubber 1/8” thick. Bolts and nuts shall conform to ANSI B18.2.1 and B18.2.2, respectively.

A. Notes: Pipe material and fittings shall meet the standards set forth for pipe and tube in the National Fire Code NFPA 13, Section 6.3.

B. Grooved joint couplings shall consist of two (2) ductile iron housing segments, pressure responsive elastomer gasket, and ASTM A449 zinc-electroplated steel bolts and nuts.

1. Rigid: Coupling housings with offsetting, angle-pattern bolt pads shall be used to provide system rigidity and support and hanging in accordance with NFPA-13. Couplings shall be fully installed at a visual pad-to-pad offset contact. Couplings that require gapping of bolt pads or specific torque ratings for proper installation are not permitted. Installation-Ready, for direct stab installation without field disassembly. Basis of Design: Victaulic Style 009H and 107N.

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2. Flexible: Use in locations where vibration attenuation and stress relief are required. Basis of Design: Victaulic Style 177 Installation-Ready, and Style 77.

2.3 VALVES

A. Valves shall be of materials and weights required by NFPA standards.

B. Valves that control mains inside building shall be approved OS&Y, 175 psi, unless noted otherwise, Basis of Design: Victaulic Series 771. Valves shall be normally open and shall accommodate tamper switches wired under Electrical Section. Victaulic Series 705 grooved end butterfly valves with pressure responsive seat, stainless steel stem (stem shall be offset from the disc centerline to provide complete 360-degree circumferential seating), and weatherproof actuator housing with built-in tamper switches UL/FM approved to 300 psi is acceptable.

C. Check valves shall be approved pattern, 250 psi, installed vertically or horizontally, Victaulic Series 717. Alarm valves shall be 300 psi UL/FM Victaulic Series 751 or approved equal suitable for variable pressure operation and wet pipe system.

D. Valves shall be UL-listed and FM-approved. Valves 2A and smaller shall be bronze body iron sized threaded end, Victaulic style 717, UL/FM approved 250 psi; valves 2-1/2” and larger shall be ductile iron body grooved end, Victaulic series 705-butterfly valve UL/FM approved at 300 psi. Valves at fire pump shall be iron body butterfly.

1. Sprinkler alarm valves and trim are described in the following charts: See Drawings for valve location and quantities.

2.4 HANGERS, ANCHORS, CLAMPS AND INSERTS

A. Hangers shall meet NFPA Standards. Provide adjustable swivel rings for piping 3” and smaller and adjustable clevis hangers for 4” and larger piping. Support piping from building structure to maintain required grade and pitch of pipe lines, prevent vibration, secure piping in place. Secure hangers to insets where practical. Hanger rods shall have machine threads.

B. Provide vertical brackets and guides for pipe risers at each floor and where horizontal piping is racked along walls. Trapeze hangers may be used where conditions permit.

C. Hanger rods shall be connected to beam clamp, or UL-listed concrete inserts. Beam clamps shall have retaining straps.

D. Hanger spacing shall meet requirements of state and local codes.

E. Pipe supports, vertical and horizontal, shall not bear on sleeves.

F. All support devices shall conform to seismic standards.

G. Provide seismic restraint calculations.

2.5 SPRINKLER HEADS

A. Provide UL-listed and/or FM-approved, (quick response for light hazard) sprinkler heads.

B. Heads shall have ordinary degree temperature ratings, except in areas subject to abnormal heating conditions, where sprinkler heads shall have temperature ratings high enough to prevent accidental discharge. Minimum fusing temperature shall be 155°F.

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C. Sprinklers shall be glass bulb type, with hex shaped wrench boss integrally cast into the sprinkler body to reduce the risk of damage during installation. (Wrenches shall be provided by the sprinkler manufacturer that directly engage the cast wrench boss). Basis of Design: Victaulic.

D. Sprinkler heads shall be by Victaulic, Tyco, or Reliable.

E. The following table indicates head types:

Sprinkler Head Specifications

Upright Sprinkler	Finish: Temperature Rating: Link: Response Application: Approvals: Equivalent to:	Bronze 155°F (212°F Mechanical Rooms) Glass bulb Standard UL, FM, Local Authority Having Jurisdiction Victaulic V27 or V34
Concealed	Finish: Cover Plate: Temperature Rating: Link: Response Application: Approvals: Equivalent to:	White (coordinate with Architect) White 155°F Glass bulb Standard UL, FM, Local Authority Having Jurisdiction Victaulic V38
Recess Pendent	Finish: Temperature Rating: Link: Response Application: Approvals: Equivalent to:	Bronze 155°F Glass bulb Standard UL, FM, Local Authority Having Jurisdiction Victaulic V27 or V34
Sidewall	Finish: Cover Plate: Temperature Rating: Link: Orifice Coefficient: Response Application: Approvals: Equivalent to:	Chrome Chrome 155°F Glass bulb 5.6 Standard UL, FM, Local Authority Having Jurisdiction Victaulic V27 or V34 HSW
Dry Vertical Recessed Pendent	Finish: Temperature Rating: Link: Response Application: Approvals: Equivalent to:	Chrome 155°F Glass bulb QR UL, FM, Local Authority Having Jurisdiction Victaulic V36 or Viking Model M

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Quick Response Extended Coverage	Finish: Temperature Rating: Link: Response Application: Approvals: Equivalent to:	Bronze 155°F Glass bulb QREC UL, FM, Local Authority Having Jurisdiction Victaulic V27 or V34
Quick Response Recessed Pendent	Finish: Temperature Rating: Link: Response Application: Approvals: Equivalent to:	Chrome 155°F - 165°F Glass bulb QR UL listed for 175 psig, FM approved to 175 psig, Local Authority Having Jurisdiction Victaulic V27 or V34 (for light hazards only)

F. Flexible Stainless Steel Sprinkler Drop Systems may be used to locate sprinklers as required by final finished ceiling tiles and walls. The drop shall include a UL approved Series AH2 braided hose with a bend radius to 2-inch to allow, for proper installation in confined spaces. The hose shall be listed for (4) bends at 31” length, (5) bends at 36” length, (8) bends at 48” length, 10 bends at 60” length, (12) bends at 72” length. Union joints shall be provided for ease of installation. The flexible drop shall attach to the ceiling grid using a one-piece open gate Series AB1 or AB2 bracket. The bracket shall allow installation before the ceiling tile is in place. The braided drop system is UL listed and FM Approved for sprinkler services to 175 psi (1206 kPa). Basis of Design: Victaulic Vic-Flex.

2.6 SPRINKLER CABINET

A. Provide enameled steel sprinkler cabinet with approved number of sprinkler heads as required by NFPA. Provide appropriate sprinkler wrench with each type of head in each cabinet.

2.7 SLEEVES AND PENETRATIONS

A. Pipe Sleeve Materials:

1. Sleeves through floors and through exterior, structural and fire-rated construction shall be galvanized Schedule 40 steel pipe.

2. Sleeves through partitions and non-fire-rated construction shall be 26 gauge galvanized steel with lock longitudinal seams or approved plastic pipe.

3. Provide waterproofing membrane locking devices at floors. Provide 150 lb. Slip-on welding flanges at exterior wall penetrations.

B. Fire stop penetration seals in fire-rated construction shall conform to ASTM E814 and shall be ceramic fiber (Proset Systems Firefill); mineral fiber (Manville Thermo-mat); or silicone foam (Dow RTV 3-6548). Provide mineral fiberboard, matting or putty for damming and forming. Finish seals flush to wall surface and fill gaps with silicone adhesive sealant caulking (Dow 96-081 RTV or approved equal). Provide 1” thick ceramic fiber board on both sides of penetrations in 2 and 3 hour rated walls and floors less than 8” thick. All penetration seals shall be installed in accordance with listing requirements.

C. Packing for sleeves that do not require maintenance of fire rating shall be oakum, silicate, foam, ceramic fiber or mineral fiber with approved sealant. Pack or foam to within one inch of both wall

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surfaces. Seal penetration packing with approved caulking and paintable waterproof mastic surface finish or silicone caulking.

D. Wall and floor penetration fire stops shall be UL listed, FM approved.

PART 3 EXECUTION

3.1 COORDINATION

A. Cooperate and coordinate with work of other Sections in executing work of this Section.

B. Verify conditions and take field measurements as required to ensure work shall fit actual conditions. Field corrections to fabricate work and adjustments to adjacent work where required for proper installation of work shall be subject to Architect's approval. Corrections and adjustments shall be permitted only when not detrimental to appearance and function of work.

3.2 SHUT DOWNS

A. Work with Owner in maintaining integrity of new or existing fire protection system. Coordinate and minimize any and all shut downs of fire protection system as follows:

1. Give proper notice to Owner when making shutdowns, a minimum of two full weeks.

2. Perform all duties required by Owner when making a shut down.

3. Fill out a shut down notice form answering all items requested such as time and location of shut down, systems affected, areas affected, etc. when requesting a shut down.

4. Provide fire watch as required during a shut down.

5. Duration of shut downs shall be kept to a minimum.

6. In no case shall the fire protection system be shut down during off-hours of work day without a fire watch.

7. System shall be returned to normal operating conditions at end of work day.

3.3 TESTS

A. Test sprinkler system as required by NFPA Insurance Underwriters, Factory Mutual and agencies that have jurisdiction.

B. Test water flow detecting devices including associated alarm circuits through inspection test connection.

C. Test sprinkler system under pressure of 200 psi for two hours. Correct defects and leaks. Caulking will not be allowed.

D. Submit written approval of tests from Authorities Having Jurisdiction over installation to Owner before Final Acceptance of work.

E. Do not backfill before testing and approval.

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F. Notify Architect and various departments and bureaus 48 hours before tests are to be made.

G. Operating test of sufficient duration shall be made for systems, equipment, fixtures and accessories to Owner's satisfaction.

H. General:

1. Test sprinkler and make watertight before painting and concealment. Make partial tests as required, during progress of work. Tests shall be witnessed by: General Contractor, Insurance Underwriter's Representative, Municipal Inspector and a representative of the Architect.

2. Sprinkler system shall be tested to hydrostatic test of 200 psi in accordance with NFPA requirements.

3. If inspection or test show defects, such defective work or material shall be replaced and inspection and tests shall be repeated. Repairs to piping shall be made with new material.

3.4 PIPE VALVE AND EQUIPMENT IDENTIFICATION

A. Provide color-coded pipe identification markers. Pipe markers shall be snap-on laminated plastic with acrylic coating. Pipe markers shall be applied after painting.

B. Provide arrow marker with each pipe content marker to indicate direction of flow. If flow can be in either direction, use double-headed arrow marker.

C. Mains shall be labeled at points of entrance and exit from mechanical room, next to valves, on risers, at tee fittings, at points of entrance and exit from building, at least once in each room and at intervals not longer than 20 feet.

D. In general, 2" high legend shall be used for pipe lines 4" diameter and larger than ¾" high legend shall be used for pipe lines 3" diameter and smaller.

E. Markers shall be Seton Setmark or approved equal.

F. Color banding shall meet latest ANSI and OSHA requirements.

G. Markers shall have legend with "black" letters:

Service	**Legend**	**Background Color**
Sprinkler	Sprinkler	Red
Combination Sprinkler-standpipe	Sprinkler-Fire	Red
Fire	Fire	Red

H. Valve Tags:

1. All valves on pipes of every description shall have neat, circular brass valve tags of at least 1.5 inches in diameter, attached with brass hook to each valve stem. Stamp on these valve tags in letter as large as practical, the number of the valve and the service such as "S.P." for sprinkler. The numbers of each service shall be consecutive.

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2. All valves on equipment, tanks and pumps shall be numbered by 3 inch diameter red metal discs with white numbers 2 inches high secured to stem of valves by means of brass hooks or small solid link brass chain.

I. Equipment:

1. Nameplates shall be made of black surface, white core laminated “Bakelite” with indented letters.

2. Nameplates shall be a minimum of 3 inches long by 1.5 inches high and bear the equipment name as designated in these Specifications.

3. Equipment identification designations shall be taken from equipment schedules as indicated on the Drawings or specified herein.

3.5 ANCHORS AND INSERTS

A. Inserts shall be UL listed and FM approved and shall be steel of type to receive machine bolt head or nut after installation. Inserts shall permit adjustment of bolt in one horizontal direction and shall develop strength of bolt when installed in properly cured concrete.

B. Provide anchors as necessary for attachment of equipment supports and hangers.

3.6 TYPICAL DETAILS

A. Typical details where shown on the Drawings shall apply to each and every item of the project where such items are applicable. They are not repeated in full on the Drawings, which in many cases are diagrammatic only, but with the intention that such details shall be incorporated in full. Any alternate method proposed for use by the Contractor shall have the prior approval of the Owner.

3.7 CORING, DRILLING

A. Core, cut and/or drill all holes in walls and floors required for the installation of sleeves and supports for the Fire Protection work.

3.8 SUPPLEMENTARY SUPPORTING STEEL

A. Provide all supplementary steelwork required for mounting or supporting equipment and materials.

B. Steelwork shall be firmly connected to building construction as required.

C. Steelwork shall be of sufficient strength to allow only minimum deflection in conformity with manufacturer’s published requirements.

D. All supplementary steelwork shall be installed in a neat and workmanlike manner parallel to floor, wall and ceiling construction; all turns shall be made at forty-five and ninety degrees, and/or as dictated by construction and installation conditions.

E. All manufactured steel parts and fittings shall be galvanized; manufacturer shall be Unistrut or equivalent.

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3.9 SPRINKLER INSTALLATION

A. Standpipes shall have pressure gauges at the top and supervised control valves at the bottom.

B. Grooved Joints: Install in accordance with the manufacturer's latest published installation instructions. Pipe ends shall be clean and free from indentations, projections and roll marks in the area from pipe end to (and including) groove. Gasket shall be manufactured by the coupling manufacturer and verified as suitable for the intended service. A factory trained representative (direct employee) of the coupling manufacturer shall provide on-site training for contractor's field personnel in the use of grooving tools, application of groove, and product installation. The representative shall periodically visit the job site and review installation to ensure best practices in grooved joint installation are being followed. Contractor shall remove and replace any improperly installed products.

C. Signaling devices shall consist of the following:

1. Electric micro switch locks on zone valves and water flow control switches on each floor supply be wired to fire alarm panel and Building Automation System.

2. Alarm devices provided on alarm valves and pipes by Sprinkler Contractor.

3. Fire alarm zone panels and wiring by Electrical Contractor and System Automation Contractor.

4. Complete coordination shall be exercised between Sprinkler Contractor and Electrical Contractor to ensure electrical connections are compatible with fire alarm system described under Electrical Section.

D. Electric micro switch locks on zone valves and water flow control switches on each floor supply wired to fire alarm panel and Building Automation Sprinkler.

E. Alarm devices provided on alarm valves and pipes by Sprinkler Contractor.

F. Fire alarm zone panels and wiring by Electrical Contractor.

G. Complete coordination exercised between Sprinkler Contractor and Electrical Contractor to ensure electrical connections are compatible with fire alarm system described under Section 26 00 00.

3.10 SEISMIC RESTRAINTS

A. All piping, equipment and devices shall be seismically supported as required by NFPA.

END OF SECTION 21 00 00

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SECTION 22 00 00 – PLUMBING

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS AND REFERENCES

A. Include “General Requirements” and applicable parts of Division 1 as part of this section.

B. Examine all other sections of the Specifications for requirements which affect work under this Section whether or not such work is specifically mentioned in this section. Where paragraphs of this section conflict with similar paragraphs of Division 1, requirements of this section shall prevail.

C. Coordinate work with that of all other trades affecting, or affected by work of this section. Cooperate with such trades to assure the steady progress of all work under the Contract.

D. The Plumbing Subcontractor shall be responsible for filing all documents, payment of all fees, and securing of all inspections and approvals necessary for the work of this section.

E. The Plumbing Subcontractor shall carry in the Bid Price all Utility Company and Municipal back charges for all materials furnished and work performed by them in conjunction with this Contract and pay same to the respective agency upon demand. The Plumbing Subcontractor shall not be entitled to additional compensation after the submittal of his bid price should he fail, for any reason, to obtain the total back charge costs to be incurred by the local utility companies or municipal agencies.

1.2 DEFINITIONS

A. As used in this section, “provide” means “furnish and install”, and “POS” means “Provided Under Other Sections”.

B. As used in the Drawings and Specifications for Plumbing work, certain non-technical words shall be understood to have specific meanings as follows, regardless of indications to the contrary in the General Conditions of other documents governing the Plumbing work.

1. “Furnish” means: Purchase and deliver to the project site complete with every necessary appurtenance and support, all as part of the Plumbing work. Purchasing shall include payment of all sales taxes and other surcharges as may be required to assure that purchased item(s) are free of all liens, claims, or encumbrances.

2. “Install” means: Unload at the delivery point at the site and perform every operation necessary to establish secure mounting and correct operation at the proper location in the project, all as part of the Plumbing work.

3. “Provide” means: “Furnish” and “Install”.

4. “New” means: Manufactured within the past two (2) years and never before used.

C. Except where modified by a specific notation to the contrary, it shall be understood that the indication and/or description of any plumbing item in the Drawings or Specifications for Plumbing work carries with it the instruction to furnish, install and connect the item as part of the Plumbing work, regardless of whether or not this instruction is explicitly stated.

D. It shall be understood that the Specifications and Drawings for Plumbing work are complimentary and are to be taken together for a complete interpretation of the Plumbing work except that

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indications on the Drawings, which refer to an individual element of work, take precedence over the Specifications where they conflict.

1.3 SCOPE

A. Perform work and provide material and equipment as shown on Drawings and as specified or indicated in this Section of the Specifications. Completely coordinate work of this Section with work of other trades and provide a complete and fully functional installation.

1. Domestic water piping system.
2. Interior sanitary waste and vent piping system.
3. Plumbing fixtures and trim.
4. Hose bibs and wall hydrants.
5. Insulation.
6. Valves.
7. Water hammer arresters.
8. Fittings unions, flanges and couplings.
9. Flashing of floor drains.
10. Service water connections to equipment.
11. Roughing and final connections to equipment.
12. Hangers, plates and inserts.
13. Cleaning, testing and disinfection of piping systems.
14. All supplementary steel for piping and equipment support.
15. Guarantees.
16. Drilling for installation of inserts.
17. Core drilling.
18. Fire seal off all penetrations in floors and walls to the rating of the barrier.
19. Cutting, patching and pipe sleeves.

B. Drawings and Specifications form complimentary requirements; provide work specified and not shown, and work shown and not specified as though explicitly required by both. Although work is not specifically shown or specified, provide supplementary or miscellaneous items, appurtenances, devices and materials obviously necessary for a sound, secure and complete installation.

C. Give notices, file plans, obtain permits and licenses, pay fees and back charges, and obtain necessary approvals from Authorities Having Jurisdiction as required to perform work in accordance with all legal requirements and with Specifications, Drawings, Addenda and Change Orders, all of which are part of Contract Documents.

D. Before submitting bid, visit and carefully examine site to identify existing conditions and difficulties that will affect work of this Section. No extra payment will be allowed for additional work caused by unfamiliarity with site conditions that are visible or readily construed by experienced observer. Site visit is particularly important because this is renovation work.

E. Before starting work in a particular area of the project, visit site and examine conditions under which work must be performed including preparatory work done under other Sections or Contracts or by Owner. Report conditions that might affect work adversely in writing through Contractor to Architect. Do not proceed with work until defects have been corrected and conditions are satisfactory. Commencement of work shall be construed as complete acceptance of existing and preparatory work.

F. Work to be done under this section is shown on the following Drawings:

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G. The following Drawings are included for reference and coordination and additional requirements for work in this section:

1.4 RELATED WORK UNDER OTHER SECTIONS

A. The following items are not included in this section and will be performed under other sections.

1. Temporary Facilities.
2. Earthwork: Excavation and backfill.
3. Concrete:
   a. Equipment foundations.
   b. Housekeeping pads.
4. Masonry: All openings in masonry walls.
5. Waterproofing, Dampproofing and Caulking.
6. Roofing and Flashing.
7. Painting: All painting except as specified herein.
8. Finish Carpentry and Millwork.
9. Steel Doors and Frames.
10. Finish Hardware.
11. Elevators and Lifts.
12. Fire Protection.
13. Electrical.
14. HVAC.
15. Foundation drains.
16. Site drainage.
17. Furnishing of toilet accessories such as toilet paper holders, mirrors and soap dispensers.
18. Utility structures.

1.5 REGULATORY REQUIREMENTS

A. Comply with all applicable Federal and State laws, and all Local codes, By-laws and Ordinances.

B. Where provisions of the Contract Documents conflict with any codes, rules or regulations, the latter shall govern. Where the contract requirements are in excess of applicable codes, rules or regulations, the contract provisions shall govern unless the Architect rules otherwise.

C. Request inspections from Authorities Having Jurisdiction, obtain all permits and pay for all fees and inspection certificates as applicable and/or required. All permits and certificates shall be turned over to the Owners at the completion of the work. Copies of permits shall be given to the resident engineer prior to the start of work.

D. Unless otherwise specified or indicated, materials and workmanship and equipment performance shall conform with the latest edition of the following standards, codes, Specifications, requirements and regulations:

1. Local and State Building, Plumbing, Mechanical, Electrical, Fire and Health Department Codes.
2. American Gas Association (AGA).
3. National Fire Protection Association (NFPA).
4. American Insurance Association (AIA), formerly National Board of Fire Underwriters.
5. Occupational Safety and Health Act (OSHA).
6. Factory Mutual Association (FM).
7. Underwriter’s Laboratories (UL).
8. Local Water and Sewer Authorities.
9. State Department of Environmental Protection Regulations.

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E. All Plumbing work shall meet or exceed any other state and local codes and/or Authorities Having Jurisdiction including all other standards indicated herein.

1.6 SUBMITTALS

A. This paragraph shall supplement Division 1.

B. Definitions:

1. Shop Drawings: Information prepared by the Contractor to illustrate portions of the work in more detail than shown in the Contract Documents.

2. Coordination Drawings: Detailed, large-scale layout Shop Drawings showing HVAC, Electrical, Plumbing and Fire Protection work superimposed to identify conflicts and ensure inter-coordination of Mechanical, Electrical, Architectural, Structural and other work.

C. Submittals Procedures and Format:

1. Review submittal packages for compliance with Contract Documents and then submit to Architect for review. Submit transparency and two (2) blue or black-line reproductions of each Shop Drawing larger than 8-1/2" x 11". Submit eight (8) sets of each smaller shop drawing. After review, transparency original of each large Shop Drawing and six (6) sets of each small shop drawing will be returned with reviewer's marks. Electronically submitted shop drawings are acceptable.

2. Each Shop Drawing shall indicate in title block, and each Product Data package shall indicate on cover sheet, the following information:
   a. Title.
   b. Name and location of project.
   c. Names of Architect, Engineer, Contractor and Subcontractor(s).
   d. Names of Manufacturer, Supplier, Vendor, etc.
   e. Date of submittal.
   f. Whether original submittal or resubmitted.

3. Shop Drawings showing manufacturer's product data shall contain detailed dimensional Drawings, accurate and complete description of materials of construction, manufacturer's published performance characteristics and capacity ratings (performance data alone is not acceptable), plumbing requirements and wiring diagrams. Drawings shall clearly indicate location (terminal block or wire number), voltage and function for all field terminations, and other information necessary to demonstrate compliance with all requirements of Contract Documents.

D. Acceptable Manufacturers:

1. The Architect's Plumbing design for each project is based on the single manufacturer listed in the schedule or shown on the Drawings. In Division 15 of these Specifications certain "Alternate Manufacturers" are listed as being acceptable. These are acceptable only if, as a minimum, they:
   a. Accepted by Architect and Engineer.
   b. Meet all performance criteria listed in the schedules and outlined in the Specifications.
   c. Have equivalent operating characteristics to those called for in the Specifications.
   d. Fit within the available space it was designed for, including space for maintenance and component removal, with no modifications to either the space or the product. Clearances to walls, ceilings and other equipment will be at least equal to those shown on the

Contract Documents. The fact that a manufacturer's name appears as acceptable shall not be taken to mean the Architect has determined that the manufacturer's products will fit within the available space. This determination is solely the responsibility of the Contractor.

e. For equipment mounted in areas where structural matters are a consideration, the products must have a weight no greater than the product listed in the schedules or Specifications.

f. Products must adhere to all architectural considerations including, but not limited to, being the same size and of the same physical appearance as scheduled or specified products.

E. Substitutions: Substitution of products by manufacturers other than those listed shall only be done in accordance with subparagraph "F" "Substitutions and Deviations".

F. Substitutions and Deviations:

1. Deviations from the Contract Documents and the substitution of materials or equipment relative to the "Acceptable Manufacturers" referred to above, shall be requested individually in writing whether deviations result from field conditions, standard shop practice, or other cause. Submit letter with transmittal of Shop Drawings which flags the substitution or deviation to the attention of the Architect. The letter shall describe changes in the system shown and physical characteristics (connections to adjacent materials, plumbing services, service access requirements, and other characteristics), and differences in operating characteristics or cycles.

2. Without letters flagging the substitution or deviation to the Architect, it is possible that the Architect may not notice such substitution or deviation or may not realize its ramifications. Therefore, if such letters are not submitted to the Architect, the Contractor shall hold the Architect and his consultants harmless for any and all adverse consequences resulting from the deviations being implemented. Adverse consequences shall include, but not be limited to, excessive noise, excessive maintenance, shortened longevity, spatial coordination problems, and inadequate performance versus scheduled design. This shall apply regardless of whether the Architect has reviewed or approved Shop Drawings containing the deviation, and will be strictly enforced.

3. Do not request substitute materials or equipment unless identical material or equipment has been operated successfully for at least three (3) consecutive years. Such materials and equipment shall be a regular cataloged item shown in the current catalog of the manufacturer. When deviation or substitution is permitted, coordinate fully with related changes to Architectural, Structural, Plumbing, Fire Protection, Mechanical, and other work. Ensure that related changes necessary for coordination of substituted items are made within the Contract Price. Assume full responsibility for safety, operation and performance of the altered system.

4. Substitutions of equipment, systems, etc. requiring approval of local Authorities must comply with such regulations and be filed by the Contractor (should filing be necessary).

5. Consideration will not be given to claims that the substituted item meets the performance requirements with lesser construction. Performance, as delineated in schedules and in the Specifications, shall be interpreted as minimum performance.

6. Approval of proposed deviations or substitutions, if any, will be made at discretion of Architect.

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7. If equipment is proposed for substitution that is not tested and rated according to industry-wide standards, the Architect shall have the right to have performance tests completed, at the Contractor's expense, to confirm the manufacturer's performance claims.

G. Submittal Notations: Submittals will be returned from the Architect marked as illustrated below:

NO EXCEPTION TAKEN	ACCEPTED AS NOTED
NOT ACCEPTED	REVISE AND RESUBMIT

1. Checking is only for general conformance with the design concept of the project and general compliance with the information given in the Contract Documents. Any action shown is subject to the requirements of the Drawings and Specifications. Contractor is responsible for dimensions which shall be confirmed and correlated at the job site; fabrication process and techniques of construction; coordination of his work with that of all other trades; and the satisfactory performance of his work.

H. Schedule: Incorporated the Shop Drawing review period into the construction schedule so that work is not delayed. Contractor shall assume full responsibility for delays caused by not incorporating the following Shop Drawing review time requirements into his project schedule. Allow at least ten (10) working days, exclusive of transmittal time, for review each time a Shop Drawing is submitted or resubmitted with the exception that fifteen (15) working days, exclusive of transmittal time, are required for the following:

I. Schedule:

1. Copies of all backflow preventer permits.
2. Certification of domestic water system disinfection.
3. Coordination Drawings, if required by this Specification.
4. Adjustment and balancing certification.
5. If more than five (5) Shop Drawings of this trade are received in one (1) calendar week.

J. List of Proposed Equipment and Materials: Within four (4) weeks after Award of Contract and before ordering materials or equipment, submit a complete list of proposed materials and equipment and indicate manufacturer's names and addresses. No consideration will be given to partial lists submitted out of sequence.

K. Responsibility:

1. The intent of submittal review is to check for capacity, rating, and certain construction features. Contractor shall ensure that work meets requirements of the Contract Documents regarding information that pertains to fabrication processes or means, methods, techniques, sequences and procedures of construction; and for coordination of work of this and other Sections. Work shall comply with submittals marked "REVIEWED" to extent that they agree with the Contract Documents. Submittal review shall not diminish responsibility under this Contract for dimensional coordination, quantities, installation, wiring, supports and access for service, nor the Shop Drawing errors or deviations from requirements of the Contract Documents. The Architect's noting of some errors while overlooking others will not excuse the Contractor for proceeding in error. Contract Documents requirements are not limited, waived, nor superseded in any way by review.

2. Inform Subcontractors, Manufacturers, Suppliers, etc. of scope and limited nature of review process and enforce compliance with the Contract Documents.

L. Material and equipment requiring Shop Drawing Submittals shall include but not be limited to:

1. Plumbing fixtures and trim.
2. Water heaters.
3. Floor drains.
4. Hose bibs and wall hydrants.
5. Piping.
6. Fittings, unions, flanges and couplings.
7. Insulation.
8. Sleeve packing.
9. Valves
10. Water hammer arresters.
11. Flashing of floor drains.
12. Hangers, plates and inserts.
13. Receptors for condensate drainage.
14. Fire-rated penetration assembles (ASTM E814, UL 1479).
15. Access panels.
16. Shop Drawings shall be submitted as a single bound package, organized and titled.

1.7 SURVEYS AND MEASUREMENTS

A. Base all required measurements, both horizontal and vertical, on reference points established by the General Contractor and be responsible for the correct laying out of the Plumbing work. In the event of a discrepancy between actual measurements and those indicated, notify the General Contractor in writing. Do not proceed with the work required until written instructions have been issued by the General Contractor.

1.8 COORDINATION

A. HVAC, Plumbing, Fire Protection, and Electrical Drawings are diagrammatic. They indicate general arrangements of Mechanical and Electrical systems and other work. They do not show all offsets required for coordination nor do they show the exact routings and locations needed to coordinate with Structural and other trades and to meet Architectural requirements.

B. Work shall be performed in cooperation with other trades on the project and so scheduled as to allow speedy and efficient completion of the work.

C. Furnish to other trades advance information on locations and sizes of all frames, boxes, sleeves and openings needed for their work. Furnish information and Shop Drawings necessary to allow trades affected by the work to install their work properly and without delay.

D. In all spaces, prior to installation of visible material and equipment, including access panels, review Architectural Drawings for exact locations and where not definitely indicated, request information from Architect. Where the Plumbing work shall interfere with the work of other trades, assist in coordinating the space conditions to make satisfactory adjustments before installation. Without extra cost to the Owner, make reasonable modifications to the work as required by normal Structural interferences. Pay the General Contractor for additional openings, or relocating and/or enlarging existing openings through concrete floors, walls, beams and roof required for any work which was not properly coordinated. Maintain maximum headroom at all locations. All piping, duct, conduit, and associated components to be as tight to underside of structure as possible.

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E. If any Plumbing work has been installed before coordination with other trades so as to cause interference with the work of such trades, all necessary adjustments and corrections shall be made by the plumbing trades involved without extra cost to the Owner.

F. Where conflicts or potential conflicts exist and engineering guidance is desired, submit sketch of proposed resolution to Architect for review and approval.

G. Protect all materials and work of other trades from damage which may be caused by the Plumbing work, and repair all damages without extra cost to the Owner.

1.9 MECHANICAL AND ELECTRICAL COORDINATION

A. Plumbing Subcontractor shall furnish and install various electrical items relating to the plumbing equipment and control apparatus. The Electrical Subcontractor shall be required to connect power wiring to this equipment unless noted otherwise.

B. The Plumbing and Electrical Subcontractors shall coordinate their respective portions of the work, as well as the electrical characteristics of the plumbing equipment.

C. All power wiring and local disconnect switches will be provided by the Electrical Subcontractor for the line voltage power. All control and interlocking wiring shall be the responsibility of the Plumbing Subcontractor.

D. 120V and above power wiring sources extended and connected to heating and ventilating control panels, transformers and switches shall be the responsibility of the Electrical Subcontractor. All low voltage thermostats, zone valve and any switch wiring shall be the responsibility of the HVAC Subcontractor.

E. Temperature control and equipment wiring shall be installed by the Plumbing Subcontractor.

F. The Electrical Subcontractor will provide all magnetic starters except those furnished as an integral part of packaged equipment.

1.10 MECHANICAL AND ELECTRICAL COORDINATION DRAWINGS

A. Coordination Drawings:

1. The Sheetmetal Subcontractor shall prepare a complete set of electronic Drawings at a scale not less than 3/8” equals 1’-0”, showing structure and other information as needed for coordination. He shall show sheetmetal layout thereon. These will be the Coordination Drawings.

2. The main paths of egress and for equipment removal, from main Mechanical and Electrical rooms must be clearly shown on the Coordination Drawings.

3. Each of the below specialty trades shall add its work to these background Drawings with appropriate elevations and grid dimensions. Specialty trade information is required for fan rooms and mechanical rooms, horizontal exits from duct shafts, crossovers, and for spaces in and above ceilings where congestion of work may occur such as corridors, and even entire floors. Drawings shall indicate horizontal and vertical dimensions, to avoid interference with structural framing, ceilings, partitions, and other services.
   a. Specialty Trades:
      1) Plumbing System.
      2) HVAC Piping and Associated Control System.
      3) Electrical.

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4) Sheet Metal Work.
5) Sprinkler System.

4. Each specialty trade shall sign and date each electronic Coordination Drawing. Return Drawings to the Sheetmetal Subcontractor, who shall route them sequentially to all specialty trades.

5. Where conflicts occur with placement of materials of various trades, the Sheetmetal Subcontractor will be responsible to coordinate the available space to accommodate all trades. Any resulting adjustments shall be initialed and dated by the specialty trade. The Sheetmetal Subcontractor shall then final date and sign each Coordination Drawing. If he cannot resolve conflicts, the decision of the General Contractor shall be final, subject to the approval of the Architect.

6. A Subcontractor who fails to promptly review and incorporate his work on the Coordination Drawings shall assume full responsibility of any installation conflicts affecting his work and of any schedule ramifications.

7. The Sheetmetal Subcontractor shall make electronic copies of all Coordination Drawings. Fabrication shall not start until such transparencies of completed Drawings are received by the Architect/Engineer and have been reviewed.

8. Review of Coordination Drawings shall not diminish responsibility under this Contract for final coordination of installation and maintenance clearances of all systems and equipment with Architectural, Structural, Mechanical, and Electrical Contractors.

1.11 INSTALLATION REQUIREMENTS

A. The arrangement of all Plumbing work shown on the Drawings is diagrammatic only and indicates the minimum requirements of the work. Conditions at the building including actual measurements shall determine the details of the installation. All work shall be laid out and installed so as to require the least amount of cutting and patching.

B. Review the Architectural Drawings and Specifications before ordering any material and equipment. Any discrepancies shall be brought to the attention of the Architect for his determination prior to proceeding with the work.

1.12 TYPICAL DETAILS

A. Typical details where shown on the Drawings shall apply to each and every item of the project where such items are applicable. They are not repeated in full on the Drawings, which in many cases are diagrammatic only, but with the intention that such details shall be incorporated in full. Any alternate method proposed for use by the Contractor shall have the prior approval of the Architect.

1.13 SLEEVES, INSERTS

A. Furnish and install all sleeves, inserts, anchor bolts and similar items to be set into masonry or concrete, as required for Plumbing work as indicated in Division 01. Internal diameter of sleeve ball shall be 1/2" larger than the outside diameter of the pipe or insulation covered line passing through it.

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1.14 CORING, DRILLING

A. Core, cut and/or drill all holes in walls and floors required for the installation of sleeves and supports for the Plumbing work as indicated in Division 01.

1.15 FIRESTOPPING, SMOKEPROOFING & WATERPROOFING

A. All cutting, patching, firestopping and waterproofing shall be performed by the Fire Suppression Subcontractor. Refer to Sections 01 73 29 – CUTTING AND PATCHING, 07 00 01 – WATERPROOFING, DAMPPROOFING & CAULKING, and 07 84 13 PENETRATION FIRESTOPPING for project requirements

1.16 ACCESSIBILITY

A. Install all work such that parts requiring periodic inspection, operation, maintenance and repair are readily accessible.

B. Furnish all access panels appropriate to particular conditions, to be installed by trades having responsibility for the construction of actual walls, floors or ceilings at required locations.

1.17 SUPPLEMENTARY SUPPORTING STEEL

A. Provide all supplementary (non-structural) steelwork required for mounting or supporting equipment and materials.

B. Steelwork shall be firmly connected to building construction as required. Locations and methods of attachment shall be approved by the Architect.

C. Steelwork shall be of sufficient strength to allow only minimum deflection in conformity with manufacturer's published requirements.

D. All supplementary steelwork shall be installed in a neat and workmanlike manner parallel to floor, wall and ceiling construction: all turns shall be made at forty-five and ninety degrees, and/or as dictated by construction and installation conditions.

E. All manufactured steel parts and fittings shall be galvanized.

1.18 TOOLS AND EQUIPMENT

A. Provide all tools and equipment required for the fabrication and installation of the plumbing equipment at the site.

1.19 PORTABLE AND DETACHABLE PARTS

A. Contractors shall retain in their possession all portable and/or detachable parts and portions of materials, devices, equipment, etc. necessary for the proper operation and maintenance of the Mechanical and Electrical systems until final completion of the work, at which time they shall be handed over to the Owners.

1.20 RECORD DRAWINGS, PROJECT CLOSEOUT

A. As work progresses and for the duration of Contract, maintain a complete and separate set of prints of Contract Drawings at job site at all times. Record work completed and all changes from original Contract Drawings clearly and accurately including work installed as a modification or

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addition to the original design. Work shall be updated on a weekly basis and shall be made available for review by Architect. Failure to perform this work shall be reason for withholding requisition payments. In addition, take photographs of all concealed equipment in gypsum board ceilings, shafts, and other concealed, inaccessible work. At completion of work, make copies of photographs with written explanation on back. These shall become part of Record Documents.

B. At the completion of work, prepare a complete set of electronic Record Drawings showing all systems as actually installed. The electronic copies will be made available for the Plumbing Contractor's copying, at his expense. The quantity of copies which are made available shall in no way be interpreted as setting a limit to the number of Drawings necessary to show the required information. The Plumbing Contractor's professional Draft Person shall transfer changes to electronic copies. Submit sets of prints to Architect for comments as indicated in Division 01 - 01 77 00 Contract Closeout..

C. The Architect will not certify the accuracy of the Record Drawings. This is the sole responsibility of the Plumbing Contractor.

D. This trade shall submit the Record Drawings for approval by the Fire and Building Departments in a form acceptable to the departments, when required by the jurisdiction.

E. Record Drawings shall show record condition of details, sections, riser diagrams, control changes and corrections to schedules. Schedules shall show actual manufacturer, make and model numbers of final equipment installation.

1.21 GUARANTEE/WARRANTY

A. Guarantee and 24 Hour Service:

1. Guarantee Work of this Section in writing for not less than one (1) year following the date of acceptance by the Owner. If the equipment is used for temporary power etc, prior to acceptance by the Owner, the bid price shall include an extended period of warranty covering the one (1) year of occupancy, starting from the date of acceptance by the Owner. The guarantee shall repair or replace defective materials, equipment, workmanship and installation that develop within this period, promptly and to the Architect's satisfaction and correct damage caused in making necessary repairs and replacements under guarantee within Contract Price.

2. In addition to guarantee requirements of Division 1 and of Subparagraph A above, obtain written equipment and material warranties offered in manufacturer's published data without exclusion or limitation, in Owner's name.

3. Upon receipt of notice from the Owner of failure of any part of the systems or equipment during the warranty period, the affected part or parts shall be replaced by this Contractor without any reimbursement.

4. Replace material and equipment that require excessive service during guarantee period as defined and as directed by Architect.

5. Provide 24 hour service beginning on the date the project is accepted by the Owner, whether or not fully occupied, and lasting until the termination of the guarantee period. Service shall be at no cost to the Owner. Service can be provided by this Contractor or a separate service organization. Choice of service organization shall be subject to Architect and Owner approval. Submit name and a phone number that will be answered on a 24 hour basis each day of the week, for the duration of the service.

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6. Submit copies of equipment and material warranties to Architect before final payment.

7. At end of guarantee period, transfer manufacturer's equipment and material warranties still in force to Owner.

8. This paragraph shall not be interpreted to limit Owner's rights under applicable codes and laws and under this Contract.

9. PART 2 paragraphs of this Specification may specify warranty requirements that exceed those of this paragraph. Those paragraphs shall govern.

10. Use of systems provided under this Section for temporary services and facilities shall not constitute Final Acceptance of Work by Owner, and shall not initiate the guarantee period.

11. Provide manufacturer's engineering and technical staff at site to analyze and rectify problems that develop during guarantee period immediately. If problems cannot be rectified immediately to Owner's satisfaction, advise the Architect in writing, describe efforts to rectify situation, and provide analysis of cause of problem. The Architect and/or Engineer will direct course of action.

1.22 OPERATING, INSTRUCTION AND MAINTENANCE MANUALS

A. Refer to Section 01 70 00 – CONTRACT CLOSEOUT and 01 78 23 – OPERATION AND MAINTENANCE DATA for submittal procedures pertaining to operating and maintenance manuals.

B. Each copy of the approved operating and maintenance manual shall contain copies of the approved Shop Drawings, equipment literature, cuts, bulletins, details, equipment and engineering data sheets and typewritten instructions relative to the care and maintenance for the operation of the equipment, all properly indexed. Each manual shall have the following minimum contents:

1. Table of Contents.

2. Introduction:
   a. Explanation of manual and its purpose and use.
   b. Description of the plumbing systems.
   c. Safety precautions necessary for equipment.
   d. Illustrations, schematics and diagrams.
   e. Installation drawing.

3. Maintenance:
   a. Maintenance and lubricating instructions.
   b. Replacement charts.
   c. Trouble-shooting charts for equipment components.
   d. Testing instructions for each typical component.
   e. Two (2) typed sets of instructions for ordering spare parts. Each set shall include name, price, telephone number and address of where they may be obtained.

4. Manufacturer's Literature:
   a. The equipment for which Shop Drawings have been submitted and approved.

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1.23 QUALITY ASSURANCE

A. The requirements of the State Building Code and Local regulations establish the minimum acceptable quality of workmanship and materials, and all work shall conform thereto unless more stringent requirements are indicated or specified herein.

B. All work shall comply with the latest editions of the codes as referenced herein.

C. Follow manufacturer's directions for articles furnished, in addition to directions shown on the Drawings or specified herein.

D. Protect all work, materials, and equipment from damage during process of work. Replace all damaged or defective work, materials and equipment without additional cost to the Owner.

E. All equipment and materials for permanent installation shall be the products of recognized manufacturers and shall be new.

F. Equipment and materials shall:

1. Where normally subject to Underwriters Laboratory Inc. listing or labeling services, be so listed and labeled.
2. Be without blemish or defect.
3. Not be used for temporary purposes.
4. Be in accordance with the latest applicable ASME standards.

G. Products shall meet with the acceptance of all Authorities Having Jurisdiction over the work. Where such acceptance is contingent upon having the products examined, tested and certified by Underwriters or other recognized testing laboratory, the product shall be so examined, tested and certified.

H. All items of equipment or material of one generic type shall be the product of one manufacturer throughout.

I. For items which are to be installed but not purchased as part of the Electrical work, the Electrical work shall include:

1. The coordination of their delivery.

2. Their unloading from delivery trucks driven into any point on the property line at grade level.

3. Their safe handling and field storage until the time of permanent placement in the project.

4. The correction of any damage, defacement or corrosion to which they may have been subjected. Replacement, if necessary, shall be coordinated with the Contractor who originally purchased the item.

5. Field erection and internal wiring as necessary for their proper operation.

6. Mounting in place, including the purchase and installation of all dunnage, supporting members, and fastenings, necessary to adapt them to architectural and structural conditions.

7. Their connection to building wiring including the purchase and installation of all termination junction boxes necessary to adapt and connect them to this wiring. Included also shall be the purchase and installation of any substitute lugs or other wiring terminations as may be

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necessary to adapt their terminals to the building wiring as called for and to the connection methods set forth in these Specifications.

J. Items which are to be installed but not purchased as part of the Plumbing work shall be carefully examined upon delivery to the project. Claims that any of these items have been received in such condition that their installation will require procedures beyond the reasonable scope of the Plumbing work will be considered only if presented in writing within one (1) week of the date of delivery to the project of the items in question. The Plumbing work includes all procedures, regardless of how extensive, necessary to put into satisfactory operation, all items for which no claims have been submitted as outlined above.

1.24 DELIVERY, STORAGE AND HANDLING

A. All materials for the work of this section shall be delivered, stored and handled so as to preclude damage of any nature. Manufactured materials shall be delivered and stored in their original containers, plainly marked with the products' and manufacturer's name. Materials in broken containers or in packages showing watermarks or other evidence of damage shall not be used and shall be removed from the site.

PART 2 PRODUCTS

2.1 PIPE MATERIALS

A. The table below indicates pipe class for each service. Refer to the following pages for expanded Specifications for the respective class.

PIPE MATERIALS SPEC INDEX

Service	Code	Maximum Operating (psig)	Service Limits (Temperature °F)	Pipe Material
Domestic Cold Water	CW	150 below grade	250	Copper
Domestic Hot Return	HWR	150 below grade	250	Copper
Domestic Hot Water	HW	150 below grade	250	Copper
Tempered Water	TW	100	250	Copper
Sanitary Waste & Vent	S	Gravity	120	Cast Iron
Storm Drain	D	Gravity	80	Cast Iron

B. Each valve type shall be the product of a single manufacturer. Each system shall be provided with valves as required by Code and shown on the Drawings and shall be installed to facilitate operation, replacement and repair.

C. Provide access panels for concealed valves behind non-removable ceilings or walls.

D. Provide shut-off valves on supply piping to individual pieces of equipment.

E. Provide pipe dope, Teflon tape, wax rings, neoprene gaskets and other jointing compounds as required by best standard practice and only on service as recommended by manufacturer.

F. Apply putties and jointing compounds for plumbing fixtures and trim as recommended by manufacturers.

G. Valves on insulated piping system shall be equipped with extended handles to accommodate insulation thickness.

H. Provide one-piece chrome plated escutcheons for all wall, floor and ceiling pipe penetrations in finished rooms and areas.

2.2 COPPER PIPE (FOR CW, HWR, HW, TW SYSTEMS)

	1/2” to 3”	4” and Larger
Pipe	Seamless copper water tube, drawn temper, Type L. ASTM B-88. See Note 1.	Seamless copper water tube, drawn temper, Type L. ASTM B-8. See Notes 2 & 5.
Fittings	Wrought copper, solder-joint. ASTM B-16.22.	Ductile iron coupling with copper alkyd enamel paint coating, ASTM A-536. Grade “E” EPDM elastomer gasket. ASTM D-2000. Equal to Victaulic Style 606 coupling. ASTM B-75 copper alloy fittings. ASTM B-584 grooved end cast bronze fittings for 6” pipe size.
Joints	ASTM B-32 solder filled material, Alloy Sb5 “95/5.” ASTM B-813 liquid or paste flux. Soldering procedures shall comply with ASTM B-828.	Rolled groove prepared and assembled in accordance with manufacturers instructions.
Mechanical Joints	Cast copper alloy unions, hexagonal stock with ball-and-socket joint, solder joint ends. ASME B-6.18.	ANSI Class 150 flange adapter equal to Victaulic Style 641 for connections to flanged equipment. ANSI B-16.1 flange dimensions. Watts G-4000-FDA series.
Valves Gate	Use ball valve.	Use ball valve.
Ball	All bronze, 3 piece, full port, PTFE seats, solder end connections. 600 psig WOG. Apollo 82-200, Milwaukee BA-350, Watts B-6801.	Class 125, cast iron body, epoxy coated. Full port, flanged ends, stainless steel ball and stem. ANSI B16.1 flange dimensions. Watts G-4000 FDA series.
Check	Bronze body and clapper, solder ends, 200 WOG. Jenkins 4093, WOG. Milwaukee 1509, Stockham B-309.	Iron body, bronze mounted, flanged ends, 200 Jenkins 625-C, Milwaukee F-2974-M, Stockham G-931.
Balancing	All bronze, 2 piece, RPTFE seats, solder end connections. 600 psig WOG. Apollo 70-100, Milwaukee BA-150, Watts B-6001. CamLock handle.	Cast iron lug body butterfly valve. Bronze disc, replaceable EPT liner and stainless steel stem, 200 psig CWP.

A. Notes:

1. Below grade water piping 3” and smaller be Type K copper with bituminous coating copper brazed joints, BcuP filler alloy. ANSI/AWS A5.8 procedures shall be per ANSI/AWS B2.2.

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2. Below grade water piping 4” and larger shall be ductile iron with AWWA C104 cement lined Class AWWA C151 piping with push-on joints.

3. Contact between dissimilar metals shall be made with dielectric couplings or dielectric flanges. Contact between ferrous and stud bolts and bronze flanges shall be electrically insulated with non-metallic washers.

4. Provide mechanical joint connections to all equipment such as water heaters, pumps, compressors, etc.

2.3 SANITARY WASTE AND VENT, STORM DRAIN

	Above Grade	Below Grade
Piping	3” and Larger: Hubless cast iron soil pipe, service weight. ASTM-A-888, CISPI 130. 2-1/2” and Smaller: Hubless cast iron soil pipe, service weight. ASTM A-88, CISPI 130 or type M copper tubing. ASTM B8872. See Note 1.	2” and Larger: Hub and spigot cast iron soil pipe, extra heavy. ASTM A-74 or service weight if Code approved. Piping shall be asphalt or coal tar pitch coated.
Fittings	3” and Larger: Hubless cast iron fittings, service weight. ASTM-A-888, CISPI 801. 2-1/2” and Larger: Hubless cast iron fittings, service weight, ASTM A-888, CISPI 301 or wrought copper DWV fittings. See Note 1.	2” and Larger: Hub and spigot cast iron fittings, extra heavy. ASTM A-74. Asphalt or coal tar pitch coated. DWV pattern.
Joints	Hubless Cast Iron: Heavy-duty stainless steel band coupling with neoprene gasket. Bank torque of 80 foot/pounds 15 psig pressure rating. Husky SD 4000 or CLAMP-ALL HI-TORQUE 80.	Caulked with leak and oakum or neoprene compression gaskets conforming to ASTM C-564.
Backwater Valve	Cast iron gravity flow type, bronze mounted, hub end. Exterior shall be mastic coated, bolted or extended cover in accordance with installation parameters. J.R. Smith Co. 7012-7022, JOSAM 67500, Zurn Industries Z-1095.	

A. Notes:

1. Copper tube and fittings shall not be used on urinal wastes.
2. CISPI 310 no-hub couplings will not be accepted as equal to manufacturer’s listed.
3. Schedule 40 DWV solid core PVC plastic pipe and fittings joined by solvent welding may be provided and installed upon written approval by Owner. Cellular (foam) core PVC shall not be installed.

2.4 INSULATION

A. Insulation shall be by Owens-Corning, Certain-Teed or Manville.

B. Insulation shall be installed by insulation firm regularly specializing in this work and employing men particularly skilled therein. No covering applied by plumber's “helpers” will be acceptable.

C. Insulation installation shall meet manufacturer’s recommendations. No insulation shall be applied until piping has passed tests as required by Authorities Having Jurisdiction.

D. Insulation, jackets and adhesives shall be flame-retardant and shall have ASTM E-84 fire hazard ratings of 25 flame spread, 50 smoke developed and 50 fuel contributed.

1. Interior Applications – Jackets:
   a. Type a – Vapor Barrier Jackets: Kraft reinforced foil vapor barrier with self-sealing adhesive joints. Jacket shall be heavy duty fire retardant material with glass fiber reinforcing and self-sealing lap. Jacket will be factory applied to the insulation. Jacket shall have neat, white Kraft finish or white vinyl suitable for painting, with bead puncture resistance of 50 units minimum. Vapor barrier shall be .001” aluminum foil adhered to the inner surface of the jacket. Permeance shall not exceed 0.02 perms. Jacket shall be Owens-Corning Fiberglass “ASJ-SSL” or Manville Flamesafe “AP-T”.
   b. Type b – PVC Jackets: One piece, pre-molded type.

E. Insulation and jacketing shall be in accordance with following:

1. Type A: Glass fiber insulation; ANSI/ASTM C547; “k” value of 0.22 – 0.28 at 100° F non-combustible.

2. Type B: Molded, flexible closed cell vinyl, ASTM D635; “k” value of 1.17 bacterial resistant.

F. Schedule: The following piping systems require insulation:

Piping System	Type	Insulation Thickness Inch (mm)	Jacket Type
Domestic Hot Water Supply/Return Less Than 1-1/2”	A	1”	a, b
Domestic Hot Water Supply/Return 1-1/2” and Larger	A	1-1/2”	a, b
Tempered Domestic Water Supply/Return Less than 1-1/2”	A	1”	a, b
Tempered Domestic Water Supply/Return 1-1/2” and Larger	A	1-1/2”	a, b
Domestic Cold Water	A	1”	a, b
Roof Drains and Horizontal Rainwater	A	1”	a, Note 3
Non-Potable Water	A	1/2”	a, b
Handicap Lav. Hot Water and Waste	B	1/8”	b

1. Notes:
   a. Unless noted otherwise, Section “F” pertains to all piping specified system. This note pertains to all piping scheduled above.

G. Pipe hangers shall be outside insulation and shall incorporate 12”, 26 gauge protection shields. Insulation on piping that passes through walls or partitions shall pass continuously through

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sleeves, except at firewalls, smoke partitions and floor penetrations where space between sleeves and piping shall be fire stopped with approved packing.

H. Insulate equipment as specified. Refer to equipment Specifications for additional requirements.

2.5 PIPE SUPPORTS

A. Provide adjustable clevis hangers for hanger sizes 4” and larger and cast brass split-ring hinged hangers or band type hangers for smaller. Support piping from building structure to maintain required grade and pitch of pipe lines, prevent vibration, secure piping in place and provide for expansion and contraction. Hangers on all insulated pipe shall be clevis type.

B. Provide vertical brackets and guides for horizontal piping where it is racked along walls. Trapeze hangers may be used where conditions permit. Provide all necessary pipe clips, anchors and sundries for proper alignment and support of piping. Hangers for copper piping shall be coated for dielectric isolation. Hangers for PVC, polypropylene and other plastic piping shall be extended V-shaped, with angle iron pipe supports as necessary.

C. Hanger rods shall have machine threads. Beam clamps, concrete inserts and expansion shields shall be provided as required. No ramset or shot shields will be allowed.

D. Hanger spacing shall meet requirements of State and Local Plumbing Codes. In no case shall horizontal piping be supported at intervals greater than 10’-0”.

E. Piping below basement or lowest level slab (that is, buried piping), need not be supported from structure if slab is not designed as structural slab. The Plumbing Contractor shall support all piping under structural slabs on grade.

F. Pipe supports shall not bear on sleeves.

G. Friction clamps shall be installed at base of plumbing risers and at each floor. Friction clamps shall not be supported from or rest on sleeves.

H. Horizontal piping shall be suspended from building structure by mild steel rod connecting pipe hanger to inserts, beam clamps, angle brackets and lag screws as required by Building Construction in accordance with the following:

Rod Size	Pipe Size
3/8”	1/2" to 2”
1/2"	2-1/2” to 4”
5/8”	5” to 12”
3/4"	15”

I. Hangers on insulated lines shall be sized to fit the outside diameter of pipe insulation. Provide hangers for insulated piping with 12” long, 18 gauge galvanized insulation shields.

J. Piping at equipment and control valves shall be supported to prevent strains or distortions in connected equipment and control valves. Piping at equipment shall be supported to allow for removal of equipment, valves and accessories with a minimum of dismantling and without requiring additional support after these items are removed.

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K. Piping installed under this Section shall be independently supported from building structure by means of beam attachments and not from piping, ductwork or conduit of other trades. Supplementary steel, including factory-fabricated channels, required to meet the requirements specified herein, shall be provided by the Plumbing Contractor.

L. Maximum spacing of hangers on runs of steel, copper or brass pipe shall be as follows:

Schedule: Hanger Spacing in Feet/Pipe Material		
Pipe Size (Inches)	Steel (Feet)	Copper or Brass (Feet)
1/2 to 1	7	5
1 to 1/4	10	6
1 to 1/2	10	8
2 to 8	10	10

M. Maximum spacing of hangers on no hub cast iron soil pipe shall be 5’ and hangers shall be provided at all changes in direction. Hanger rods to support piping from the structure or supplementary steel shall not exceed 4’ in total length. Where pipe support assemblies exceed 4’ in total length, Plumbing Contractor shall provide factory-fabricated channels and associated accessories.

N. Hangers in areas exposed to weather or in unheated spaces shall be provided with a shop coat of rust inhibited paint. Hanger rods shall be hot dipped galvanized.

2.6 SLEEVES, INSERTS, FIRE STOPPING AND ESCUTCHEONS

A. All pipes passing through floors, walls or partitions shall be provided with sleeves having an internal diameter one inch larger than the outside diameter of pipe. Pipe Sleeve Materials:

1. Sleeves through floors and through exterior, structural and fire-rated construction, shall be hot dipped galvanized Schedule 40 steel pipe. Sleeves shall extend 1” above finished floor.

2. Sleeves through partitions and non-fire-rated construction shall be 26 gauge galvanized steel with lock longitudinal seams or approved plastic pipe.

3. Provide waterproofing membrane locking devices at floors. Provide 150 lb. Slip-on welding flanges at exterior wall penetrations.

4. Provide one-piece chrome plated escutcheons for all wall, floor and ceiling pipe penetrations in finished rooms and areas.

B. Fire stop penetration seals in fire-rated construction shall be products of STI SpecSeal, 3M, Proset Systems Firefill or Dow and shall be installed in accordance with the latest requirements of ASTM E814 (UL 1479). Fire stop penetration sealants for non-metallic and insulated piping shall be intumescent (STI SpecSeal Series 100 Sealant or SpecSeal Collar or approved equal). Provide mineral fiberboard, matting or putty for damming and forming. Finish seals flush to wall surface and fill gaps with silicone adhesive sealant caulking (Dow 96-081 RTV or approved equal). Provide 1” thick ceramic fiberboard on both sides of penetrations in 2 and 3 hour rated walls and floors less than 8” thick.

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C. Packing for sleeves that do not require maintenance of fire rating shall be oakum, silicate foam, ceramic fiber or mineral fiber with approved sealant. Pack or foam to within one inch of both wall surfaces. Seal penetration packing with approved caulking and paintable waterproof mastic surface finish or silicone caulking.

D. Waterproof Pipe Penetrations:

1. Sleeves through outside walls shall be provided with pipe to wall penetration closures equal to Link-Seal Thunderline Corporation. Seals shall be mechanical type of interlocking rubber links shaped to fill space between pipe and sleeve. Links shall be assembled with bolts to form a belt around the pipe with pressure plate under each bold head and nut. After seal assembly is positioned, tightening of bolts will provide watertight seal. This Contractor shall determine the required inside diameter of each individual sleeve before ordering, fabricating or installing. The inside diameter of each sleeve shall be sized as recommended by the manufacturer to fit the pipe and Link-Seal to assure a watertight joint.

2. Prefabricated modular sleeves shall be Mason Industries (SWS) or approved equal stiffened galvanized steel sleeves with preformed closed-cell elastomeric seal (non-fire rated) or preformed mineral fiber or silicone foam seal (fire rated).

3. Provide waterproof 1” single ring set in silicone and bolted to floor or wall at chipped and drilled penetrations of existing slabs on grade and existing walls below grade.

E. Inserts shall be individual or strip type or pressed steel construction with accommodation for removable nuts and threaded rods up to 3/4" diameter, permitting lateral adjustment. Individual inserts shall have an opening at the top to allow reinforcing rods up to 1/2" diameter to be passed through the insert body. Strip inserts shall have attached rods with hooked ends to allow fastening to reinforcing rods.

F. Unless otherwise specified herein, escutcheons shall be cast brass chrome plated type and provided with a set screw to properly hold escutcheon in place.

2.7 CLEANOUTS, TRAPS AND STRAINERS

A. Provide cleanouts in soil, waste and storm drainage piping on straight runs at changes in directions and at foot of stacks and other points where required by inspecting Authorities. Cleanouts shall suit construction in which they are to be installed.

B. Maximum horizontal distance on straight runs between cleanouts in piping 4” and smaller shall be 50 feet. In piping 5” and larger, maximum horizontal distance between cleanouts shall be 100 feet.

C. Cleanouts shall be same size as pipe 4” and smaller. Cleanouts for piping larger than 4” shall be sized per local code and in no circumstance shall they be less than 4” in diameter. No reduction in cleanout sizes for pipe 4” and smaller is permitted.

D. Traps not integral with fixtures and in accessible locations shall have brass trap screw protected by water seal and will be regarded as cleanout.

E. Bodies of cleanout ferrules in bell and spigot piping shall be standard pipe sizes conforming in thickness to that required for pipe and fittings and shall extend not less than 3/4" above hub of pipe.

1. Cleanout plug shall be cast brass with raised nut 3/4" high.

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2. Cleanouts in copper waste piping shall be soldered brass cleanout fittings with extra heavy brass screw plugs of same size as line.

3. Cleanouts in threaded waste piping shall be cast iron, drainage T pattern, 90 branch fitting with extra heavy brass screw plugs of same size as pipe.

4. Floor cleanouts in finished areas shall be per schedules equivalent to J.R. Smith, Wade or Zurn.

5. Floor cleanouts in unfinished areas shall be per schedules equivalent to J.R. Smith, Wade or Zurn.

F. Provide test tees with cleanout plugs at foot vertical soil, waste, acid waste and roof conductor lines and at each floor. Cleanouts on vertical lines concealed behind finished walls shall extend to back of finish wall; provide wall plate. Obtain Architect's approval for wall plate locations and reroute piping if necessary.

G. Cleanouts shall open in direction of flow of drainage line served or at right angles thereto.

H. Keep cleanout plugs clean and unimpeded. Prevent covering with cement, plaster or other permanent finished materials.

2.8 THERMOMETERS AND PRESSURE GAUGES

A. Provide bronze Bourdon tube pressure gauges where shown on Contract Drawings and where specified, by U.S. Gauge, Trerrice or Weksler, accurate to +1%.

1. Gauges shall have white faces with black-filled engraved lettering. Gauge bodies shall be set in phenolic cases. Provide pulsation dampers and gauge cocks to isolate each gauge.

2. Gauges shall be easily accessible and easily read. Gauges readable from floor at less than 5 feet shall be 4-1/2" dials. Other gauges shall have 6" dials. Gauges graduations shall meet limit requirements of normal operation. Gauges shall indicate at mid-scale.

3. Provide pressure gauges at the inlet and outlet of each pump.

4. Provide pressure gauges at each water entrance, downstream of the water meter and on each side of PRV stations.

B. Provide separable well V-case thermometers by U.S. Gauge, Terrice or Weksler where shown on Contract Drawings and where specified. Thermometers shall have 9" scale and white face with black-filled engraved letters. Thermometers shall be angular or straight stemmed, as conditions necessitate. Thermometer wells shall be bronze and shall be installed so as to ensure minimum restriction of water flow in pipe and shall be installed to be able to be viewed from the floor.

1. Provide thermometer at the inlet and outlet of each water heater and where shown on Contract Drawings. Thermometers shall have scale range of 30°-240° F with 2° scale division.

2. Provide thermometer in hot water return system at each hot water recirculation pump and where shown on Contract Drawings. Scale range shall be 30°-240° F with 2° scale division.

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2.9 WALL HYDRANTS AND HOSE BIBBS

A. Provide wall hydrants as shown on the Drawings. Provide hose bibs in every toilet core where more than one (1) flushing fixture is shown.

B. Wall hydrant shall be recessed box anti-siphon, non-freeze, key-operated, 3/4". Hydrant shall be J.R. Smith or equivalent by Josam or Zurn. Coordinate cover and plate finish with Architect prior to ordering any units.

C. Hose bib shall be chrome plated bronze or brass with replaceable hexagonal disc, hose thread spout and integral vacuum breaker in conformance to ANSI/ASSE 1011. Hose bib shall be equal to Chicago No. 952 or equivalent, T&S Brass or Watersaver.

2.10 WATER HAMMER ARRESTERS

A. Provide water hammer arresters at all fixtures with automatic solenoid or cylinder operated valves, automatic flush valves quick-closing valves or solenoid valves and where indicated on Drawings.

B. Fixtures and equipment in battery installation may use single water hammer arrester properly sized for connected load.

C. Provide proper access to water hammer arresters in chases, utilizing a minimum 12” x 12” access panel furnished by this Contractor.

D. Water hammer arresters shall be installed in accordance with manufacturer’s recommendations and not less than one (1) installed per core piping hot system and core piping cold system. Arresters shall be equal to J.R. Smith, Zurn or PPP.

2.11 PLUMBING FIXTURES AND TRIM

A. Refer to Architectural and Plumbing Drawings for quantities, locations and mounting heights of fixtures provided under this Section.

1. Refer to Fixture Schedules on P001.

B. Fixture trim, traps, faucets, escutcheons and waste pipes exposed to view in finished spaces shall be I.P.S. brass with polished chromium plating (CP) over nickel finish.

C. Vitreous china fixtures shall be regular selection fused and vitrified to produce homogeneous material with close grain without pores. Surfaces that contact walls, floors and other fixtures shall be set true.

D. Enameled surfaces on cast iron fixtures shall be of suitable thickness to provide the highest commercial grade. Exterior exposed surfaces not enameled shall be treated at factory with one (1) coat of filler.

E. Affix manufacturer’s guarantee label or trademark to fixture to indicate first quality. Acid-resisting enamel fixture shall bear manufacturer’s symbol signifying resistance to acid.

F. Set fixtures with wall outlet flanges at proper distance from floors and walls with closet setting compound or gasket.

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G. Catalog designations and manufacturer's names of vitreous china and enameled cast iron fixtures are specified to establish standards of quality for performance and materials. Equivalent fixtures by Toto, American Standard or Eljer may be submitted for consideration.

H. Vitreous china and enameled cast-iron fixtures shall be white throughout, unless specified otherwise. Closet seats shall match closet fixture color.

I. Fixture Types: As listed on Contract Drawings.

1. Notes:
   a. Standards:
      1) Floor Drains:
         a) Cast Iron – ASME A112.21.1M
         b) Plastic – ASTM A112.21.M
      2) Cleanouts: Cast Iron – ASME A112.36.2M
      3) Sleeve Systems: UL 1479

2.12 EQUIPMENT – GENERAL

A. The following mechanical equipment is to be supplied by a single manufacturer as part of this package unless otherwise noted.

1. Refer to Equipment Schedules on P001.

B. Equipment Tags:

1. All equipment shall be tagged using black phenol background with a 1/4" white engraved lettering tag affixed to the piece. Tag shall be minimum of 2" high and 4" long for large equipment and shall include the tag number and the piece.

2. Equipment Tag Sequence (Example):
   a. G-CMP – 1XXX where:
   b. G – Indicates system (Natural Gas)
   c. CMP – Indicates equipment (Booster Pump)
   d. 1 – Indicates piece number (1, 2, 3…)
   e. XXX – Indicates building number (if applicable)

C. All equipment furnished in the following pages shall be furnished with seismic anchoring points. Equipment supplied shall be constructed with a seismic rating.

PART 3 EXECUTION

3.1 DEMOLITION

A. Disconnect and dismantle existing plumbing systems and equipment to be demolished and leave debris and disconnected equipment on floor for removal under Section 20 70 00 – SELECTIVE DEMOLITION.

B. Remove existing plumbing stacks, mains and branches when serving fixtures to be demolished. Remove piping back to active main and provide valve cap or plug to suit system. Obtain existing record Drawings from Owner. Maintain existing plumbing risers and stacks serving fixtures to remain.

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C. After walls and ceilings are removed and piping is exposed, verify piping serves only plumbing fixtures indicated for demolition before shut-down for disconnection. Identify existing piping which serves fixtures to remain. Promptly notify Architect of active piping to be maintained when located in partitions to be demolished.

D. Remove existing stacks and risers located in existing partitions to be demolished and provide new off-set at ceiling and drop through floor and reconnect to existing services at the floor below.

3.2 COORDINATION

A. Cooperate and coordinate with work of other Sections in executing work of this Section.

3.3 EXPANSION PROVISIONS

A. Allow for expansion with offsets, loops, swing joints, expansion joints and other means, where necessary to protect piping systems as shown. Take-offs from mains to run outs shall not have less than a three (3) elbow swing.

B. Anchor mains and risers with loops or offsets to structure to impart expansion toward loops and offsets. Anchors shall be forged wrought iron, secured to pipe and structure. Provide vibration isolation as required and as specified.

C. Provide pipe alignment guides to guide expanding pipe to move freely from anchor points towards expansion joints, offsets and other expansion provisions.

3.4 PIPE IDENTIFICATION

A. Provide color-coded pipe identification markers on piping installed under this section. Pipe markers shall be snap-on laminated plastic protected by clean acrylic coating. Pipe markers shall be applied after Architectural painting where such is required.

B. Provide arrow marker with each pipe content marker to indicate direction of flow. If flow can be in either direction, use double-headed arrow marker.

C. Main shall be labeled at points of entrance and exit from mechanical room, adjacent to each valve, on each riser, at each tee fitting, at points of entrance and exit from building, at least once in each room and at intervals no longer than 20’.

D. In general, 2” high legend shall be used for pipe lines 4” in diameter and larger, and 3/4" high legend shall be used for pipe lines 3” in diameter and smaller.

E. Markers shall be Seton, MIS or approved equivalent.

F. Color banding shall meet ANSI latest and OSHA requirements.

G. Markers shall have legends and color coding with black letters:

1. Markers are to be applied to all piping, regardless of under jacket colors per the following schedule:

Service	Legend	Background Color
Cold Water	Cold Water	Green
Hot Water	Domestic Hot Water	Yellow

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Hot Water Return	Domestic Hot Water Return	Yellow
Sanitary	Sanitary Sewer	Green
Vent	Vent	Yellow
Rainwater	Storm Sewer	Green

H. In all areas without hung ceilings, colored PVC jackets shall be used per the schedule.

1. All insulated piping exposed in mechanical rooms shall be covered with a Ceel-Co plastic jacket. Color pattern and system identification legend shall be as in the schedule.

2. This plastic jacket shall include fitting covers and piping covers.

3. Piping to be covered with this plastic jacket shall be insulated and finished as herein specified and then the plastic jacket shall be applied.

3.5 TAGS, VALVES, EQUIPMENT AND INSTRUMENTS

A. Upon completion of work, attach engraved laminated plastic tags to all valves and instrumentation. Equipment shall bear a stamped stainless tag. Tags shall have black characters on white face, consecutively numbered and prefixed with letter “P” for general valves. Tags shall bear the number used in the P&IDs for those items so marked.

B. Embossed or engraved aluminum or brass tags may be substituted if desired. Tags shall be at least 1/8” thick.

C. Tags shall be at least 1” diameter with numerals at least 3/8” high and attached by “S” hooks and chains.

D. Nameplates, catalog numbers and rating identifications shall be securely attached to electrical and mechanical equipment with screws or rivets. Adhesives or cements will not be permitted.

E. Non-potable water outlets shall be identified with permanently attached yellow color-code or 4” high triangle tag reading “Water Unsafe”.

F. Coordinate numbering system with existing piping tags as not to duplicate numbers.

3.6 FLASHING AND COUNTER FLASHING

A. Floor drains shall be flashed watertight with 20 ounce sheet copper flashing which shall extend 8” beyond drain flashing flange.

B. Provide counter flashing for roof penetrations required under this Section including vents and roof drains.

C. Flashing of vents, roof drains and other penetrations of roof required under this Section shall be done under other Sections.

3.7 JOINTS AND CONNECTIONS

A. Joints and connections shall be permanent and shall be gas and water-tight. Jointing shall be types specified for serviced indicated. Joints and connections shall meet requirements of manufacturer’s best recommended practice. All transitions between different piping materials shall be made using approved adapters. Adapters for transitions between two (2) types of piping materials shall be manufactured for purpose intended.

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3.8 INTERIOR WATER SUPPLY SYSTEM

A. Provide a complete, new (domestic and/or protected) hot and cold water piping system as indicated on Drawings and as specified, including supplies to fixtures and indicated equipment. Piping shall be pitched at least 1” in 40 feet so that it can be drained completely at low points with drain valves. Piping shall be pitched up toward fixtures for proper air relief. Provide automatic air vents with outlet piped to floor and gate valve ahead of air vents, where offsets cannot be vented by means of fixture connections.

1. Pipe used in piping assembly shall be clean and shall have ends square and reamed before putting into fittings.

2. Cut tube to required length with hacksaw or tube cutter designed for copper work.

3. Remove burrs from inside and outside of cut edge and clean end of tube with steel wool or sand cloth until discoloration is removed and metal is smooth and bright.

4. Oxides shall be removed by sand cloth and brush.

5. Removal of oxides or discoloration of pipe and fittings by acids or self-cleaning flux is forbidden.

6. Apply a thin, uniform and complete coating of reliable brand of soldering flux (Nokorode or Crest) to cleaned surfaces of tube and fittings.

7. When joints are soldered, remove excess solder with a cloth or brush leaving a fillet of solder in chamber at end of the fitting.

8. Where quick closing valves such as solenoid or flush valves are being used, piping shall be protected from water hammer by shock absorbers. Shock absorbers shall be installed at all batteries of fixtures that are operated by flush valves. Shock absorbers shall be as manufactured by PPP, J.R. Smith, or Zurn, and shall conform to the Plumbing and Drainage Institute (PDI) published requirements.

9. Connections to tanks and equipment shall be made with unions.

10. Water services supplying the building shall flow through in-line strainers and shall have containment backflow protection as indicated.

11. Shut-off and control valves on main distribution and branch lines shall be located for easy access and operation. Branch piping shall be valved with access panels provided as required at locations shown on Drawings and determined in field.

3.9 INTERIOR SANITARY WASTE, STORM, DRAINAGE AND VENT PIPING

A. Provide waste, drainage and vent lines shown in building as shown on Drawings. Vents shall extend through roof and shall increase to at least 4”. Piping shall be assembled and installed without undue strains and stresses and provision shall be made for expansion, contraction and structural settlement.

B. Interior horizontal sanitary waste and storm drainage piping shall be installed in practical alignment at uniform grade of at least 1/8” per foot, but 1/4" per foot where code dictates and as shown on Drawings.

C. Vents from fixtures or line of fixtures, when connected to vent line serving other fixtures, shall be extended at least 6” above flood level rim of highest of fixtures to prevent use of vent line as waste. No vent terminal shall be directly beneath door, window or other ventilating opening of building, nor shall any vent be within 12 feet horizontally of such opening.

D. Provide sleeves for pipe that pass through walls.

E. Provide 3” air gap on equipment and drains that discharge to floor drains.

F. Provide an air gap in which the vertical distance through the free atmosphere between the waste pipe and the floor rim of the receptacle into which it is discharging is a minimum of 2 pipe diameters greater.

G. Piping shall be run straight and plumb and offsets shall be made at an angle of not less than 45.

H. Carefully lay out work in advance so pipes pass through openings and permit proper pitch to stacks. Due to extensive ventilation and lighting systems all trades shall coordinate work with work of other trades.

I. Hub and spigot soil pipe shall be thoroughly assembled with joints of picked oil-free oakum packed tightly into space between pipes to a depth of 1-1/2”. Remaining space shall be filled in by pouring with molten lead, caulked to ensure tight joints without straining bell. After caulking, lead shall be flush with ends of bell.

J. No hub soil pipe shall be assembled with any hub heavy-duty stainless steel couplings and neoprene gaskets.

K. Cleanouts:

1. Provide cleanouts with brass caps and screws same size as pipe up to 4 inches and not less than 4 inches for larger piping at the ends of all branches on soil and waste piping and in such other portions of the piping where run is over 50 feet. Locate floor cleanouts as indicated on Drawings.

3.10 FIXTURE ROUGHINGS

A. Install rough plumbing including fixture carriers and supports, valves and water hammer arresters within chase tolerances. Supply roughing through finish walls and at hose bibbs and shower heads shall be secure and free of movement. Locate valves and water hammer arresters within 12 inches of approved access panel location.

B. Align exposed waste and supply pipe roughings with fixture connections within 1 inch tolerance. Provide flush valves in alignment with the fixture, without vertical or horizontal offsets. Obtain fixture manufacturer roughing data sheets for recommended roughing dimensions.

C. Provide fixture templates for Casework Contractor for counter mounted sinks and lavatories.

1. Rough handicapped use water closets to locate the flush valve handle on the wide side of the toilet stall.

D. Secure fixture supports to floor slab construction with lag bolts and metal expansion shields to support at least 250 pounds on the front rim of the fixture for 5 minutes.

E. Mounting heights shall be in accordance with all local and state codes and latest ADA Standards.

F. Provide fixture rough-in piping connections, sizes in accordance with schedule on Drawings.

3.11 EQUIPMENT ROUGHINGS AND CONNECTIONS

A. Provide roughing and final connections for water, waste systems including indirect wastes, traps, tailpieces, stops and supplies, valves and unions for all equipment and fixtures including those supplied under other sections.

B. Provide complete plumbing roughings with capped and valved service with union of flange to suit Owner furnished equipment.

C. Refer to Architectural floor plans and Equipment schedules for all equipment provided under other sections or by Owner. Roughing for all equipment including floor drain locations shall be based on approved Shop Drawings. Install indirect waste discharge to spill into floor drain funnel. Floor drain grate and sediment bucket shall be removable.

3.12 INSTALLATION OF SPECIALTY ITEMS

A. Install vacuum relief valves located above the top of the heater on cold water supply lines to water heaters.

B. Gauges: Install gauges where indicated on the Drawings and as specified. Install pressure gauges at water service entrance on inlet and outlet sides of strainers, filters, backflow preventers and pumps. Install temperature gauges on inlet and outlet side of water heaters and on recirculation line at least 10 feet upstream of circulation pumps. Gauges shall be legible from 4 feet to 6 feet above the floor.

C. Trap Primers: Install trap primer and related piping through the floor and connect to primer connection on floor drains in all areas where maintaining the trap seal could be a problem.

D. Water Hammer Arresters: Provide water hammer protection at all self-closing fixtures and equipment. Equip quick-closing valves such as flush valves and solenoids with water hammer arresters. Banks of plumbing fixtures may be protected with a single properly sized and located PDI certified arrester. Obtain approval for access panel location prior to installation.

3.13 INSTALLATION OF FIXTURES

A. Mount fixtures level at the elevations shown on Architectural Drawings. Refer to toilet room elevations and casework details.

B. Install handicapped use fixtures in accordance with the requirements to the Architectural Access Board Code, latest ADA standards and ANSI A117.1. Insulate hot water supply and waste piping under lavatories.

1. Where urinals are provided, install one urinal with the rim mounted 17 inches above the finish floor in compliance with the Handicapped Code.

C. Grout walls and floor mounted fixtures watertight where the fixtures are in contact with walls and floors.

D. Caulk deck-mounted trim at the time of assembly, including fixture and casework mounted. Caulk self-rimming sinks installed in casework.

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3.14 CLEANING

A. Clean systems thoroughly before testing. Fixtures, equipment, pipe, valves and fittings shall be free of grease, metal cuttings, dirt and other foreign material. Remove protective covers. Fixtures (including lavatories, water closets and urinals) shall be cleaned and ready for use.

B. Repair stoppage, discoloration and damage to parts of building, finish and furnishings due to failure to properly clean piping system within Contract Price.

C. After completion of project, clean the exterior surface of equipment included in this section, including concrete residue.

D. After the completion of the work, all materials and equipment surfaces shall be thoroughly cleaned and polished in accordance with the finish of the material. All chromed surfaces shall be highly polished.

E. Before the systems are tested and balanced, pipes and equipment shall be thoroughly cleaned so that no dirt, dust, or other foreign matter will be deposited in or carried through the systems.

F. Water and steam systems shall be thoroughly flushed and cleansed of any and all deleterious materials at least once before system is placed in operation. At this time, these systems will be carefully checked for leaking and defects as hereinafter specified. An approved cleansing agent will be used in flushing.

G. At all times, keep the premises clear of undue accumulation of rubbish.

H. On completion of the work, remove all rubbish and debris resulting from this contract and dispose of same. At any time should the General Contractor be dissatisfied with the performance of clean-up responsibilities, he may elect, after proper notification, to undertake this operation and back charge this Subcontractor accordingly.

I. All equipment shall be thoroughly cleaned and left in a satisfactory condition for proper operation at project completion.

J. Before placing orders for pre-cleaned pipe, fittings, valves, etc., the Contractor shall submit the manufacturer's cleaning Specifications to the Engineer for approval.

K. The supplying of pre-cleaned materials or the Engineer's approval of the manufacturer's cleaning Specifications, does not relieve the Contractor of the responsibility for meeting the requirements for cleanliness outline in this specification.

3.15 DISINFECTION OF WATER SYSTEMS - INTERIOR

A. Water piping systems shall be thoroughly disinfected with a solution containing no less than 50 parts per million of available chlorine. Chlorinating materials shall be either liquid chlorine or sodium hypochlorite solution, and shall be introduced into the system and drawn to all points in the system. Disinfection solution shall be allowed to remain in system for 24 hours. During this time, valves and faucets shall be opened and closed several times. After disinfection, solution shall be flushed from the system with clear water until residual chlorine content is no greater than 0.2 parts per million.

1. Notify all parties 48 hours prior to cleaning system.

2. Bypass all building filters.

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3. Perform chlorination prior to heating the domestic hot water system. Run circulation pumps on the domestic HW system.

4. Provide advance notice to all trades prior to procedure. Post warning signs throughout the job site.

5. Collect samples randomly and at end user points.

B. Work shall be supervised by Owner and performed by approved chemical testing laboratory and results sent to the Architect or Architect's representative for verification.

C. Testing laboratory shall submit a summary of test procedure for approval prior to any work performed. Subcontractor shall provide valves required to disinfect water supply system in part as required by phasing of construction and to provide isolating valves and draw-off valves for proper containment, phasing and flushing.

3.16 TESTING AND ADJUSTING – GENERAL

A. Scope:

1. Test and adjust plumbing systems as specified and as required by Code and Contract Documents.

2. Testing, balancing and adjusting shall in no way relieve guarantee requirements.

3. Provide services of qualified personnel, equipment and apparatus required to perform tests.

4. All systems shall be thoroughly adjusted for perfect intended operation. All mechanical equipment shall be adjusted for flow, temperature, etc. of fluid. The entire hot water circulation system shall be thoroughly balanced so hot water draw from fixtures shall be as quickly available as possible. Pumps, relief valves and pressure reducing valves shall be adjusted as required. Submit in writing to the Engineer upon completion of this work that it is complete and ready for use.

B. Before date of acceptance, furnish Architect with certificates of testing and inspection indicating approval of Authorities Having Jurisdiction and conformance with requirements of Contract Documents.

C. General:

1. Submit proposed test procedures, recording forms and test equipment for review before testing.

2. Notify Architect and Authorities involved at least 48 hours before testing and inspection.

3. Do not paint, cover or conceal work before testing, inspecting and obtaining approval; this includes backfilling and application of insulation.

4. Costs of repairs and restoration of work of other trades and of existing building surfaces or material damaged during cleaning or testing shall be borne by trade performing cleaning or testing.

D. No tests shall be started until systems have been cleaned as described under "Cleaning" paragraph. Provide temporary piping and connections for testing, flushing or draining systems to be tested.

1. Repair or replace leaks, damage and defects that result from tests to like-new condition. Remove and replace defective materials with acceptable materials.

2. Piping and joints shall be made tight without caulking. Continue tests until systems operate without adjustments and repair to equipment or piping.

3. Provide testing instruments, force pumps, gauges, equipment and labor necessary to conduct tests. Instruments used for testing and balancing shall have been calibrated within six months before balancing. Instrument calibration shall be certified.'

4. Submit six (6) copies of complete testing and balancing report to Architect for review.

E. Final test shall be made after vertical and horizontal pipes and roughing-in have been run and before sewer or fixture connection is made.

1. After soil, waste and storm lines, etc. have been installed outlets shall be temporarily plugged up.

2. Fill pipes with water to top of vertical lines and allow them to remain so filled for 24 hours.

3. Retesting after leaks are repaired shall be at no additional cost.

F. Pressurized Piping Systems:

1. Leak tests shall be conducted in accordance with ANSI applicable codes and as specified herein.

2. Before piping of various systems has been covered or furred-in, piping systems shall be tested tight for 1 hour under hydrostatic pressure, 1-1/2 times systems working pressures, but not greater than test pressure of 150 psig.

3. Tests shall be witnessed by Architect and pronounced satisfactory before pressure is removed or any water drained off.

4. Equipment shall be valved off or removed during test if equipment pressure rating is less than test pressure.

5. Retest systems after leaks are repaired within Contract Price.

G. Gravity Systems: Test under water pressure at heads specified in Plumbing Codes. Fill pipe lines with water to top of 5 foot vertical section of pipe or to level of top of vent pipe; maintain head pressure for 30 minutes.

H. Potable Water System Test:

1. Certification of the potable water system integrity shall be required where separate systems of potable and non-potable water are provided to supply plumbing fixtures.

2. Fill potable water system to capacity with clean clear water. Introduce water at top of piping system (Hot and Cold). During filling, introduce green food coloring dye into piping system. A floor-by-floor survey shall be conducted. Operate each outlet (Hot and Cold) connected to potable water system until coloring has been observed. A method of maintaining the level of water and coloring shall be employed in order to make up the drawn off amounts. A survey sheet shall indicate each floor and the room number sequentially.

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3. This survey is required to be performed after all pressure testing and flushing of the piping system, but before sterilization. Further, it is required that all fixtures connected to the potable water system be installed prior to the test.

I. Pumps shall be tested to check impeller trim and operating characteristics. Following data shall be recorded and submitted to Architect for review:

1. Flow at operating conditions where flow venturi or orifices are installed in system.

2. Shutoff pressure required to check impeller trim.

3. Discharge pressure at operating conditions.

4. Suction pressure at operating conditions.

5. Motor amperage on each phase at operating conditions.

J. Prove capacity and performance of each piece of equipment by field tests as specified herein various paragraphs. Equipment and instruments required for tests, as well as additional thermowells or gauge connections shall be installed at no additional cost to Owner.

1. Qualified representative of Equipment Manufacturer shall be present. Architect may witness tests, if he so desires.

2. Test requirements shall include, but not be limited to, the following:
   a. Domestic water pumps.
   b. Sump pumps.
   c. Sewage ejectors.

K. Examine Part 2 for supplemental testing requirements.

3.17 TESTING: PIPING SYSTEMS

A. General:

1. Piping systems shall be subjected to testing water or air as noted and shall hold tight at the pressure head stated for the time interval required without adding air or water. While any system is being tested, required head or pressure shall be maintained until joints are inspected.

2. Tests shall be witnessed by inspector having jurisdiction, and the Architect within 48 hour notice, given these Authorities.

3. Equipment, material, and labor required for testing of various systems, or part thereof, shall be provided by Plumbing Contractor.

B. Sanitary, Waste and Roof Water Conductor System:

1. Water test shall be applied to drainage system either in their entirety or in sections as required, after rough piping has been installed.

2. If applied to entire system, openings in piping system shall be tightly closed, except the highest opening and system filled with water to point of overflow.

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3. If system is tested in sections, each opening shall be tightly closed except highest opening in the section under test and each section shall be filled with water but no section shall be tested with less than a 10' head of water.

4. In testing successive sections, at least upper 10' of next preceding section shall be tested so that no joint of piping in building, except the uppermost 10' of the system shall be submitted to a test of less than a 10' head of water.

5. Water shall be kept in system for at least 15 minutes before inspection starts; the system shall then be made tight at all points.

C. Points of drainage systems tested with air instead of water shall be tested by attaching an air compressor testing apparatus to suitable opening and, after closing all other inlets or outlets, forcing air into systems until a uniform gauge pressure of 5 psi or sufficient pressure to balance a column of mercury 10" high. Pressure shall be held without introduction of additional air for a period of at least 15 minutes.

D. All new and existing sanitary, waste and vent piping installed under the floor slab, in the area of work, shall be video camera scoped and recorded upon completion and prior to final acceptance. Any debris found in underground piping shall be flushed and removed as part of this contract. All video recordings and results shall be submitted to the Owner as part of the closeout documents.

E. Interior Water Piping System: Upon completion of water supply systems or section thereof, as required, system shall be tested and proved tight under a water pressure of 150 psi. Gauge shall be located on lowest new floor and pressure shall hold for a period of one (1) hours without introducing additional water. Water used for testing shall be from a potable source of supply.

F. Testing Summary:

1. W&V – with water to a 10 foot head for 30 minutes.
2. Water – with potable water to 150 psi for one hour.

G. Defective Work: If inspection or tests show defects, such defective work or material shall be replaced and inspection and tests shall be repeated. Repairs to piping shall be made with new material. No caulking or screwed joints or holes shall be acceptable.

H. Additional Tests:

1. Provide additional tests such as smoke pressure tests as required by regulations or as directed by Authorities making the inspection.

2. Provide for any repeated test as directed by the Architect, to make all systems tight as required.

3. Visual inspections of joints and valves shall be made as directed by the Architect.

3.18 SEISMIC RESTRAINTS

A. All piping, equipment and devices shall be seismically supported as required by the Building Code.

END OF SECTION 22 00 00

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SECTION 15600
HVAC

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS AND REFERENCES

A. Include “General Requirements” and applicable parts of Division 1 as part of this section.

B. Examine all other sections of the Specifications for requirements which affect work under this Section whether or not such work is specifically mentioned in this section. Where paragraphs of this section conflict with similar paragraphs of Division 1, requirements of this section shall prevail.

C. Coordinate work with that of all other trades affecting, or affected by work of this section. Cooperate with such trades to assure the steady progress of all work under the Contract.

D. The HVAC Subcontractor shall be responsible for filing all documents, payment of all fees, and securing of all inspections and approvals necessary for the work of this section.

1.2 DEFINITIONS

A. As used in this section, “provide” means “furnish and install”, “POS” means “Provided Under Other Sections” and “HVAC” means “Heating, Ventilating and Air Conditioning”.

B. As used in the Drawings and Specifications for Mechanical Work, certain non-technical words shall be understood to have specific meanings as follows, regardless of indications to the contrary in the General Conditions of other documents governing the HVAC work.

1. “Furnish” means: Purchase and deliver to the project site complete with every necessary appurtenance and support, all as part of the HVAC work. Purchasing shall include payment of all sales taxes and other surcharges as may be required to assure that purchased item(s) are free of all liens, claims, or encumbrances.

2. “Install” means: Unload at the delivery point at the site and perform every operation necessary to establish secure mounting and correct operation at the proper location in the project, all as part of the HVAC work.

3. “Provide” means: “Furnish” and “Install”.

4. “New” means: Manufactured within the past two (2) years and never before used.

C. Except where modified by a specific notation to the contrary, it shall be understood that the indication and/or description of any HVAC item in the Drawings or Specifications for HVAC work carries with it the instruction to furnish, install and connect the item as part of the HVAC work, regardless of whether or not this instruction is explicitly stated.

D. It shall be understood that the Specifications and Drawings for HVAC work are complimentary and are to be taken together for a complete interpretation of the HVAC work except that indications on the Drawings, which refer to an individual element of work, take precedence over the Specifications where they conflict.

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1.3 SCOPE

A. Perform work and provide material and equipment as shown on Drawings and as specified or indicated in this Section of the Specifications. Completely coordinate work of this Section with work of other trades and provide a complete and fully functional installation.

B. Give notices, file plans, obtain permits and licenses, pay fees and back charges, and obtain necessary approvals from Authorities that have jurisdiction as required to perform work in accordance with all legal requirements and with Specifications, Drawings, Addenda and Change Orders, all of which are part of Contract Documents.

C. Work shall include, but shall not be limited to, the following:

1. Tie-ins to existing ductwork and hot water supply/return piping.
2. Relocation of existing systems which interfere with new construction.
3. Coordinate maintenance of existing services during construction with Owner.
4. Special coordination of chases and plenums as specified in Paragraph 3.02 (SPECIAL RESPONSIBILITIES).
5. Hoisting and rigging required to complete the work of this Section.
6. Sleeves, inserts and hangers.
7. Equipment bases and supports.
8. Motors.
9. Pressure gauges and thermometers.
10. Fin tube radiation.
11. Condensate discharge system including condensate pumps.
12. Sheetmetal work.
13. Complete air distribution system including low and medium pressure ductwork, diffusers, registers, grilles, splitters, dampers, etc.
14. Insulation for duct, piping equipment.
15. Rooftop heating and ventilating units and related equipment.
16. Hot water unit heaters.
17. Pipe, duct, valve and equipment identification.
18. Instruction manuals and startup instructions.
19. Testing and balancing.
20. Cleaning.
21. Automatic temperature controls and other controls.

D. Work to be done under this section is shown on the following Drawings: M001, MD100, MD101, MD200, M100, M101, M200, M201, M300.

E. Before submitting bid, visit and carefully examine site to identify existing conditions and difficulties that will affect work of this Section. No extra payment will be allowed for additional work caused by unfamiliarity with site conditions that are visible or readily construed by experienced observer. Site visit is particularly important because this is renovation work.

F. Before starting work in a particular area of the project, visit site and examine conditions under which work must be performed including preparatory work done under other Sections or Contracts or by Owner. Report conditions that might affect work adversely in writing through Contractor to Architect. Do not proceed with work until defects have been corrected and conditions are satisfactory. Commencement of work shall be construed as complete acceptance of existing and preparatory work.

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1.4 RELATED WORK UNDER OTHER SECTIONS

A. The following items are not included in this section and will be performed under the designated sections.

1. Excavation and backfill.

2. Concrete work, including concrete housekeeping pads and other pads and blocks for vibrating and rotating equipment.

3. Cutting and patching of masonry, concrete, tile and other parts of structure, with the exception of drilling for hangers and providing holes and openings in metal decks.

4. Flashing of roof fans, or rooftop HVAC units, and of ductwork and all roof penetrations.

5. Installation of access panels in floor, wall, furred space or above ceiling.

6. Painting, except as specified herein.

7. Electric power wiring for all equipment.

8. Structural supports necessary to distribute loading from equipment to roof or floor except as specified herein.

9. Temporary light, power, water, heat, gas and sanitary facilities for use during construction and testing.

10. Gypsum drywall enclosures of supply and return ductwork on all rooftop air handlers, supply and return airshafts, as shown on Drawings.

11. Finish carpentry and millwork.

12. Fire protection.

13. Plumbing.

14. Electrical.

1.5 REGULATORY REQUIREMENTS

A. Perform work strictly as required by rules, regulations, standards, codes, ordinances and laws of Local, State and Federal governments, and all other Authorities that have legal jurisdiction over the site. Materials and equipment shall be manufacturer installed and tested as specified in latest editions of applicable publications, standards, rulings and determinations of:

1. Local and State Building, Plumbing, Mechanical, Electrical, Fire and Health Department Codes.
2. American Gas Association (AGA).
3. National Fire Protection Association (NFPA).

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4. American Insurance Association (A.I.A.) (formerly National Board of Fire Underwriters).
5. Occupational Safety and Health Act (OSHA).
6. Factory Mutual Association (FM).
7. Underwriters' Laboratories (UL).

B. Material and equipment shall be listed by Underwriters' Laboratories (UL), and approved by ASME and AGA for intended service.

C. When requirements cited in this Specification conflict with each other or with Contract Documents the most stringent shall govern work. The Architect may relax this requirement when such relaxation does not violate the rulings of Authorities that have jurisdiction. Approval for such relaxation shall be obtained in writing.

D. Most recent editions of applicable Specifications and publications of the following organizations shall form part of the Contract Documents.

1. American National Standards Institute (ANSI).
2. American Society of Mechanical Engineers (ASME).
3. National Electric Manufacturers Association (NEMA).
4. American Society for Testing and Materials (ASTM).
5. American Water Works Association (AWWA).
6. American Society for Heating, Refrigerating and Air Conditioning Engineers (ASHRAE).
7. Air Moving and Conditioning Association (AMCA).
8. Sheetmetal and Air Conditioning Contractors National Association (SMACNA).
9. Air Conditioning and Refrigeration Institute (ARI).
10. Thermal Insulation Manufacturers Association (TIMA).

1.6 SUBMITTALS

A. This section shall supplement Division 1.

B. Definitions:

1. Shop Drawings: Information prepared by the Contractor to illustrate portions of the work in more detail than shown in the Contract Documents.

2. Coordination Drawings: Detailed, large-scale layout Shop Drawings showing HVAC, Electrical, Plumbing and Fire Protection work superimposed to identify conflicts and ensure inter-coordination of Mechanical, Electrical, Architectural, Structural and other work.

3. Manufacturer's Product Data: Information prepared by the manufacturer which depicts standard equipment.

C. Submittals Procedures and Format:

1. Review submittal packages for compliance with Contract Documents and then submit to Architect and Engineer for review. Submittal packages shall be sent electronically, either emailed or through utilization of a web based construction administration application such as Procore or Submittal Exchange. All reviews will be returned in kind, either by email or through the web based application with a cover sheet and applicable submittal notations per below.

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2. Each Shop Drawing shall indicate in title block, and each Product Data package shall indicate on cover sheet, the following information:
   a. Title.
   b. Name and location of project.
   c. Names of Architect, Engineer, Contractor and Subcontractor(s).
   d. Names of Manufacturer, Supplier, Vendor, etc.
   e. Date of submittal.
   f. Whether original submittal or resubmitted.

3. Shop Drawings showing layouts of systems shall contain sufficient plans, elevations, sections, details and schematics to describe work clearly. They shall be ¼" = 1'-0" and shall indicate work of other Sections where physical clearances are critical and where interferences are possible. Provide larger scale details as necessary. Sheetmetal Drawings shall show elements of Architect's reflected ceiling plan, exposed ductwork, walls, partitions, diffusers, registers, grilles, fire dampers, sleeves and other aspects of construction as necessary for coordination.

D. Acceptable Manufacturers:

1. The Architect's Mechanical/Electrical design for each project is based on the single manufacturer listed in the schedule or shown on the Drawings. In Division 15 of these Specifications certain "Alternate Manufacturers" are listed as being acceptable. These are acceptable only if, as a minimum, they:
   a. Meet all performance criteria listed in the schedules and outlined in the Specifications.
   b. Have identical operating characteristics to those called for in the Specifications.
   c. Fit within the available space it was designed for, including space for maintenance and component removal, with no modifications to either the space or the product. Clearances to walls, ceilings and other equipment will be at least equal to those shown on the Contract Documents. The fact that a manufacturer's name appears as acceptable shall not be taken to mean the Architect has determined that the manufacturer's products will fit within the available space. This determination is solely the responsibility of the Contractor.
   d. For equipment mounted in areas where structural matters are a consideration, the products must have a weight no greater than the product listed in the schedules or Specifications.
   e. Products must adhere to all architectural considerations including, but not limited to, being the same size and of the same physical appearance as scheduled or specified products.

E. Required used of acceptable manufacturers on this project: Substitution of products other than those of the Acceptable Manufacturers specified herein shall not be made. Only the specified items or the comparable product by one of the specified "Alternate Manufacturers" shall be submitted. Products by other manufacturers shall not be used on this project.

F. Deviations:

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1. Concerning deviations other than substitutions, proposed deviations from Contract Documents shall be requested individually in writing whether deviations result from field conditions, standard shop practice, or other cause. Submit letter with transmittal of Shop Drawings which flags the deviation to the attention of the Architect.

2. Without letters flagging the deviation to the Architect, it is possible that the Architect may not notice such deviation or may not realize its ramifications. Therefore, if such letters are not submitted to the Architect, the Contractor shall hold the Architect's and his consultants harmless for any and all adverse consequences resulting from the deviations being implemented. This shall apply regardless of whether the Architect has reviewed or approved Shop Drawings containing the deviation, and will be strictly enforced.

3. Approval of proposed deviations, if any, will be made at discretion of the Architect.

G. Submittal Notations: will be returned from the Architect marked as illustrated below:

☐ NO EXCEPTION TAKEN	☐ ACCEPTED AS NOTED
☐ NOT ACCEPTED	☐ REVISE AND RESUBMIT

1. Checking is only for general conformance with the design concept of the project and general compliance with the information given in the Contract Documents. Any action shown is subject to the requirements of the Drawings and Specifications. Contractor is responsible for dimensions which shall be confirmed and correlated at the job site; fabrication process and techniques of construction; coordination of his work with that of all other trades; and the satisfactory performance of his work.

H. Schedule: Incorporate the Shop Drawing review period into the construction schedule so that work is not delayed. Contractor shall assume full responsibility for delays caused by not incorporating the following Shop Drawing review time requirements into his project schedule. Allow at least ten (10) working days, exclusive of transmittal time, for review each time a Shop Drawing is submitted or resubmitted with the exception that fifteen (15) working days, exclusive of transmittal time, are required for the following:

1. Automatic temperature controls.
2. Coordination Drawings, if required by this Specification.
3. If more than five (5) Shop Drawings of this trade are received in one (1) calendar week.

I. List of Proposed Equipment and Materials: Within four (4) weeks after Award of Contract and before ordering materials or equipment, submit a complete list of proposed materials and equipment and indicate manufacturer's names and addresses. No consideration will be given to partial lists submitted out of sequence.

J. Responsibility:

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1. The intent of submittal review is to check for capacity, rating, and certain construction features. Contractor shall ensure that work meets requirements of the Contract Documents regarding information that pertains to fabrication processes or means, methods, techniques, sequences and procedures of construction; and for coordination of work of this and other Sections. Work shall comply with submittals marked “REVIEWED” to extent that they agree with the Contract Documents. Submittal review shall not diminish responsibility under this Contract for dimensional coordination, quantities, installation, wiring, supports and access for service, nor the Shop Drawing errors or deviations from requirements of the Contract Documents. The Architect’s noting of some errors while overlooking others will not excuse the Contractor for proceeding in error. Contract Document requirements are not limited, waived, nor superseded in any way by review.

2. Inform Subcontractors, Manufacturers, Suppliers, etc. of scope and limited nature of review process and enforce compliance with the Contract Documents.

K. Material and equipment requiring Shop Drawing and/or Manufacturer’s Data Submittals shall include but not be limited to:

1. Fittings, valves and strainers.
2. Water system special fittings.
3. Diffusers, registers, grilles, splitters, dampers and accessories.
4. Exhaust fans.
5. Fin-tube radiation.
6. VRF/ductless split system.
7. Automatic controls.
8. Insulation.
9. Pressure gauges and thermometers.
10. Pipes, pipe hangers, sleeves and inserts.
11. Equipment bases and supports.
12. Cabinet unit heaters.
13. Identification for pipe, duct, valves and equipment.
14. Complete ductwork Shop Drawings, construction details and duct construction standards.

1.7 SURVEYS AND MEASUREMENTS

A. Base all required measurements, both horizontal and vertical, on reference points established by the General Contractor and be responsible for the correct laying out of the Mechanical work. In the event of a discrepancy between actual measurements and those indicated, notify the General Contractor in writing. Do not proceed with the work required until written instructions have been issued by the General Contractor.

1.8 COORDINATION

A. HVAC, Plumbing, Fire Protection, and Electrical Drawings are diagrammatic. They indicate general arrangements of Mechanical systems and other work. They do not show all offsets required for coordination nor do they show the exact routings and locations needed to coordinate with Structural and other trades and to meet Architectural requirements.

B. Work shall be performed in cooperation with other trades on the project and so scheduled as to allow speedy and efficient completion of the work.

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C. Furnish to other trades advance information on locations and sizes of all frames, boxes, sleeves and openings needed for their work. Furnish information and Shop Drawings necessary to allow trades affected by the work to install their work properly and without delay.

D. In all spaces, prior to installation of visible material and equipment, including access panels, review Architectural Drawings for exact locations and where not definitely indicated, request information from Architect. Where the HVAC work shall interfere with the work of other trades, assist in coordinating the space conditions to make satisfactory adjustments before installation. Without extra cost to the Owner, make reasonable modifications to the work as required by normal Structural interferences. The Mechanical Contractor shall be liable for any additional openings, or relocating and/or enlarging existing openings through concrete floors, walls, beams and roof required for any work which was not properly coordinated. Maintain maximum headroom at all locations. All piping, duct, conduit, and associated components to be as tight to underside of structure as possible.

E. If any HVAC work has been installed before coordination with other trades so as to cause interference with the work of such trades, all necessary adjustments and corrections shall be made by the trades involved without extra cost to the Owner.

F. Where conflicts or potential conflicts exist and engineering guidance is desired, submit sketch of proposed resolution to Architect for review and approval.

G. Protect all materials and work of other trades from damage which may be caused by the Mechanical work, and repair all damages without extra cost to the Owners.

1.9 MECHANICAL AND ELECTRICAL COORDINATION

A. The HVAC Subcontractor shall furnish and install various electrical items relating to the heating and ventilating equipment and control apparatus. The Electrical Subcontractor shall be required to connect power wiring to this equipment unless noted otherwise.

B. The HVAC and Electrical Subcontractors shall coordinate their respective portions of the work, as well as the electrical characteristics of the heating, ventilating and air conditioning equipment.

C. All power wiring and local disconnect switches will be provided by the Electrical Subcontractor for the line voltage power. All control and interlocking wiring shall be the responsibility of the HVAC Subcontractor.

D. 120V and above power wiring sources extended and connected to HVAC control panels, transformers and switches shall be the responsibility of the Electrical Subcontractor. All low voltage thermostats and any switch wiring shall be the responsibility of the HVAC Subcontractor.

E. Temperature control and equipment wiring shall be installed by the HVAC Subcontractor.

F. The Electrical Subcontractor will provide all magnetic starters except those furnished as an integral part of packaged equipment.

1.10 INSTALLATION REQUIREMENTS

A. The arrangement of all HVAC work shown on the Drawings is diagrammatic only and indicates the minimum requirements of the work. Conditions at the building including actual measurements shall determine the details of the installation. All work shall be laid out and installed so as to require the least amount of cutting and patching.

B. Review the Architectural Drawings and Specifications before ordering any material and equipment. Any discrepancies shall be brought to the attention of the Architect for his determination prior to proceeding with the work.

1.11 TYPICAL DETAILS

A. Typical details where shown on the Drawings shall apply to each and every item of the project where such items are applicable. They are not repeated in full on the Drawings, which in many cases are diagrammatic only, but with the intention that such details shall be incorporated in full. Any alternate method proposed for use by the Contractor shall have the prior approval of the Architect.

1.12 SLEEVES, INSERTS

A. Furnish and install all sleeves, inserts, anchor bolts and similar items to be set into masonry or concrete, as required for mechanical work. Internal diameter of sleeve ball shall be 1/2" larger than the outside diameter of the pipe or insulation covered line passing through it.

1.13 CORING, DRILLING

A. Core, cut and/or drill all small holes 4.5” diameter or less in walls and floors required for the installation of sleeves and supports for the Mechanical Electrical work.

1.14 ACCESSIBILITY

A. Install all work such that parts requiring periodic inspection, operation, maintenance and repair are readily accessible.

B. Furnish all access panels appropriate to particular conditions, to be installed by trades having responsibility for the construction of actual walls, floors or ceilings at required locations.

1.15 SUPPLEMENTARY SUPPORTING STEEL

A. Provide all supplementary (non-structural) steelwork required for mounting or supporting equipment and materials.

B. Steelwork shall be firmly connected to building construction as required. Locations and methods of attachment shall be approved by the Architect.

C. Steelwork shall be of sufficient strength to allow only minimum deflection in conformity with manufacturer’s published requirements.

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D. All supplementary steelwork shall be installed in a neat and workmanlike manner parallel to floor, wall and ceiling construction: all turns shall be made at forty-five and ninety degrees, and/or as dictated by construction and installation conditions.

E. All manufactured steel parts and fittings shall be galvanized.

1.16 TOOLS AND EQUIPMENT

A. Provide all tools and equipment required for the fabrication and installation of the mechanical equipment at the site.

1.17 PORTABLE AND DETACHABLE PARTS

A. Contractors shall retain in their possession all portable and/or detachable parts and portions of materials, devices, equipment, etc. necessary for the proper operation and maintenance of the Mechanical and Electrical systems until final completion of the work, at which time they shall be handed over to the Owners.

1.18 RIGGING REQUIREMENTS

A. The work to be done under this Section of the Specifications shall include all hoisting, scaffolding and planking including the furnishing, set-up and maintenance of all derricks, hoisting machinery, cranes, helicopters, scaffolds, staging and planking as required for the work.

B. Provide installation and erection information including; lifting requirements, and any special rigging or installation requirements for all equipment under the submittals.

1.19 RECORD DRAWINGS, PROJECT CLOSEOUT

A. As work progresses and for the duration of Contract, maintain a complete and separate set of prints of Contract Drawings at job site at all times. Record work completed and all changes from original Contract Drawings clearly and accurately including work installed as a modification or addition to the original design. Work shall be updated on a weekly basis and shall be made available for review by Architect. Failure to perform this work shall be reason for withholding

requisition payments. In addition, take photographs of all concealed equipment in gypsum board ceilings, shafts, and other concealed, inaccessible work. At completion of work, make copies of photographs with written explanation on back. These shall become part of Record Documents.

B. At the completion of work, prepare a complete set of Record Drawings showing all systems as actually installed. The copies will be made available for the HVAC Contractor's copying, at his expense, to serve as backgrounds for the Record Drawings. The quantity of copies which are made available shall in no way be interpreted as setting a limit to the number of Drawings necessary to show the required information. The HVAC Contractor's professional Draft Person shall transfer changes to electronic CAD files. Submit three (3) sets of electronic copies to Architect for comments as to compliance with this section.

C. The Architect will not certify the accuracy of the Record Drawings. This is the sole responsibility of the Mechanical Contractor.

D. This trade shall submit the Record Drawings for approval by the Fire and Building Departments in a form acceptable to the departments, when required by the jurisdiction.

E. Record Drawings shall show record condition of details, sections, riser diagrams, control changes and corrections to schedules. Schedules shall show actual manufacturer, make and model numbers of final equipment installation.

1.20 GUARANTEE/WARRANTY

A. Guarantee and 24 hour service.

1. Guarantee Work of this Section in writing for not less than one (1) year following the date of acceptance by the Owner. If the equipment is used for temporary heat, cooling, etc, prior to acceptance by the Owner, the bid price shall include an extended period of warranty covering the one (1) year of occupancy, starting from the date of acceptance by the Owner. The guarantee shall repair or replace defective materials, equipment, workmanship and installation that develop within this period, promptly and to the Architect's satisfaction and correct damage caused in making necessary repairs and replacements under guarantee within Contract Price.

2. In addition to guarantee requirements of Division 1 and of Subparagraph A above, obtain written equipment and material warranties offered in manufacturer's published data without exclusion or limitation, in Owner's name.

3. Upon receipt of notice from the Owner of failure of any part of the systems or equipment during the warranty period, the affected part or parts shall be replaced by this Contractor without any reimbursement.

4. Replace material and equipment that require excessive service during guarantee period as defined and as directed by Architect.

5. Provide 24 hour service beginning on the date the project is accepted by the Owner, whether or not fully occupied, and lasting until the termination of the guarantee period. Service shall be at no cost to the Owner. Service can be provided by this Contractor or a separate service organization. Choice of service organization shall be subject to Architect and Owner approval. Submit name and a phone number that will be answered on a 24 hour basis each day of the week, for the duration of the service.

6. Submit copies of equipment and material warranties to Architect before final payment.

7. At end of guarantee period, transfer manufacturer's equipment and material warranties still in force to Owner.

8. This paragraph shall not be interpreted to limit Owner's rights under applicable codes and laws and under this Contract.

9. PART 2 paragraphs of this Specification may specify warranty requirements that exceed those of this paragraph. Those paragraphs shall govern.

10. Use of systems provided under this Section for temporary services and facilities shall not constitute Final Acceptance of Work by Owner, and shall not initiate the guarantee period.

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11. Provide manufacturer's engineering and technical staff at site to analyze and rectify problems that develop during guarantee period immediately. If problems cannot be rectified immediately to Owner's satisfaction, advise the Architect in writing, describe efforts to rectify situation, and provide analysis of cause of problem. The Architect and/or Engineer will direct course of action.

1.21 OPERATING, INSTRUCTION AND MAINTENANCE MANUALS

A. Obtain at time of purchase of equipment, three copies of operation, lubrication and maintenance manuals for all items. Assemble literature in coordinated manuals with additional information describing combined operation of field-assembled units, including as-built wiring diagrams. The manual shall contain the names and addresses of manufacturers and local representatives who stock or furnish repair parts for items or equipment. Divide manuals into three sections or books as follows:

1. Directions for and sequence of operation of each item of HVAC system, e.g. VRF/ductless split system, exhaust fan. Sequence shall list valves, switches and other devices used to start, stop and control system. Detail procedure to be followed in case of malfunctions. Include detailed approved flow diagrams of temperature control, heating, condensate, etc. as appropriate for systems provided. Include approved valve directory showing each valve number, location of each valve and equipment or fixture controlled by valve.

2. Detailed maintenance and troubleshooting manuals containing data furnished by manufacturer for complete maintenance. Include copy of balancing report.

3. Lubrication instructions detailing type of lubricant, amount and intervals recommended by manufacturer for each item of equipment. Include additional instructions necessary for implementation of first class lubrication program. Include approved summary of lubrication instructions in chart form, where appropriate.

B. Furnish three copies of manuals to the Architect for approval and distribution to the Owner. Deliver manuals no less than 30 days prior to acceptance of equipment to permit the Owner's personnel to become familiar with equipment and operation prior to acceptance.

C. Provide framed and glazed charts as follows: mount as directed by the Architect.

1. Flow diagrams from first part of manual as described above.
2. Valve directory.
3. Lubrication chart from third part of manual.

D. Operating Instructions: Upon completion of installation or when the Owner accepts portions of building and equipment for operational use, instruct the Owner's operating personnel in any or all parts of the various systems. Instructions shall be performed by factory authorized personnel. The Owner shall determine which systems require additional instructions. The duration of instructions shall take equipment through complete cycle of operation (at least five working days). Make adjustments under operating conditions.

E. Each contractor shall be responsible for his work and equipment until finally inspected, tested and accepted. Carefully store materials and equipment which are not immediately installed after delivery to site. Close open ends of work with temporary covers or plug during construction to prevent entry of obstructing material.

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F. Each separate contractor shall protect the work and material of other trades that might be damaged by his work or workmen and make good all damage thus caused.

1.22 SERVICE CHARACTERISTICS

A. Secondary Building Voltage – High Level: 277/480.

B. Secondary Building Voltage – Low Level: 120/208.

C. All equipment and wiring shall be suitable for the applied voltage.

D. All motors rated 1/2 horsepower and above shall be 208V or 480V, 3-phase.

1.23 QUALITY ASSURANCE

A. The requirements of the State Building Code and Local regulations establish the minimum acceptable quality of workmanship and materials, and all work shall conform thereto unless more stringent requirements are indicated or specified herein.

B. All work shall comply with the latest editions of the codes as referenced herein.

C. Follow manufacturer's directions for articles furnished, in addition to directions shown on Drawings or specified herein.

D. Protect all work, materials, and equipment from damage during process of work. Replace all damaged or defective work, materials and equipment without additional cost to the Owner.

E. All equipment and materials for permanent installation shall be the products of recognized manufacturers and shall be new.

F. Equipment and materials shall:

1. Where normally subject to Underwriters Laboratory Inc. listing or labeling services, be so listed and labeled.

2. Be without blemish or defect.

3. Not be used for temporary purposes.

4. Be in accordance with the latest applicable ASHRAE standards.

G. Purchase products which will meet with the acceptance of all Authorities Having Jurisdiction over the work. Where such acceptance is contingent upon having the products examined, tested and certified by Underwriters or other recognized testing laboratory, the product shall be so examined, tested and certified.

H. Except for plans, all items of equipment or material of one generic type shall be the product of one manufacturer throughout.

I. For items which are to be installed but not purchased as part of the HVAC work, the Mechanical Contractor work shall include:

1. The coordination of their delivery.

2. Their unloading from delivery trucks driven into any point on the property line at grade level.

3. Their safe handling and field storage until the time of permanent placement in the project.

4. The correction of any damage, defacement or corrosion to which they may have been subjected. Replacement, if necessary, shall be coordinated with the Contractor who originally purchased the item.

5. Field erection and internal wiring as necessary for their proper operation.

6. Mounting in place, including the purchase and installation of all dunnage, supporting members, and fastenings, necessary to adapt them to architectural and structural conditions.

J. Items which are to be installed, but not purchased as part of the HVAC work shall be carefully examined upon delivery to the project. Claims that any of these items have been received in such condition that their installation will require procedures beyond the reasonable scope of the HVAC work will be considered only if presented in writing within one (1) week of the date of delivery to the project of the items in question. The mechanical work includes all procedures, regardless of how extensive, necessary to put into satisfactory operation, all items for which no claims have been submitted as outlined above.

1.24 DELIVERY, STORAGE AND HANDLING

A. All materials for the work of this section shall be delivered, stored and handled so as to preclude damage of any nature. Manufactured materials shall be delivered and stored in their original containers, plainly marked with the products' and manufacturer's name. Materials in broken containers or in packages showing watermarks or other evidence of damage shall not be used and shall be removed from the site.

PART 2 PRODUCTS

2.1 DUCTWORK AND AIR DISTRIBUTION EQUIPMENT

A. Reference Standards:

1. Material, construction and installation shall meet requirements of most recent editions of the following standards and references, except for more stringent requirements specified or shown on the Drawings:

Standard	As Applicable To
SMACNA HVAC Duct Construction Standards Metal and Flexible	Sheetmetal Ductwork; Duct Liners; Adhesives; Fasteners; Flexible Ductwork
SMACNA HVAC Air Duct Leakage Test Manual	Duct Leakage Testing
SMACNA Fibrous Glass Duct	Fibrous Glass Ductwork; Tapes

Construction Standards	
ADC and TIMA Flexible Duct Performance Standards	Flexible Ductwork
NFPA 90A	Fire Dampers; Fire Resistance Standards for Ducts and Liners
SMACNA Guidelines for Welding Sheetmetal	Welded Galvanized, Black Iron and Stainless Ductwork

B. General:

1. Provide supporting and hanging devices necessary to install the entire HVAC system including ductwork and equipment, and to prevent vibration.

2. Provide vertical and horizontal supports as required by code to meet minimum applicable earthquake resistance standards.

3. Ductwork shall be free from vibration under all conditions of operation. Dimensions shown on the Drawings for lined ductwork are net inside dimensions. Increase ductwork dimensions to accommodate lining requirements.

4. Pipe or conduit crossing duct: No pipe, conduit, hanger, Architectural element nor structural member shall pass through ductwork.

5. When making offsets and transformations necessary to accommodate structural conditions, preserve full cross-sectional area of the ductwork as shown on the Drawings.

6. Ductwork shall have pressure-velocity classifications as follows:

Duct Construction Class	Static Pressure Rating	Pressure	SMACNA Seal Class	SMACNA Leakage Class	Velocity
2”	2”	Pos. or Neg.	B	12	2500 fpm or less
1”	1”	Pos. or Neg.	B	12	2500 fpm or less
1/2”	½”	Pos. or Neg.	B	12	2000 fpm or less

a. Unless otherwise specified or shown on the Drawings, the following pressure classifications shall be used for the types of ductwork listed below:
   1) 2” Class: All ductwork.

7. Support:
   a. Space hangers as required by SMACNA (8 ft. max.) for horizontal duct on 8 ft. centers, unless concentrated loadings require closer spacing.
   b. Support vertical duct on each floor or slab it penetrates.
   c. Supports for ductwork and equipment shall be galvanized unless specified otherwise.

8. Connections:
   a. Connect inlets and outlets of fans to ductwork with flexible connections unless fan has vibration isolator mounts inside unit with flexible connections and no external vibration isolators. Exception: Do not use flex on life safety smoke exhaust fans.

b. Indoors, flexible connections shall be neoprene-coated fibrous glass fire retardant fabric, by Ventifabrics, or Durodyne. Outdoors, flexible connections shall be DuPont hyplon-coated fibrous glass fire, weather and UV-resistant by Ventifabrics or Durodyne.
c. Secure flexible connections tightly to air handlers with metal bands. Bands shall be same material as duct construction.
d. Connections from trunk to branch duct shall be as detailed on Drawings.

9. Construction:
a. No sharp metal edges shall extend into air streams.
b. Install drive slips on air-leaving side of duct with sheetmetal screws on 6” centers.
c. Spin in collars shall NOT be used for branch connections in 3” or higher pressure class ductwork.

10. Joints:
a. Longitudinal lock seams shall be double-locked and flattened to make tight joints.
b. Make transverse joints, field connections, collar attachments and flexible connections to ducts and equipment with sheetmetal screws or bolts and nuts. Do not use rivets or staples.

11. Prefabricated Transverse Duct Joints:
a. Transverse joints in galvanized sheetmetal ductwork may be made with galvanized gasketed frame and angle duct systems by Ductmate, TDF, TDC or approved equal. Angles shall be at least 20 gauge. Prefabricated transverse duct joints shall not be used for duct 16 ga. and heavier, nor for duct 23 ga. and lighter.
b. Secure angles to duct with screws (using clutched arbor) or spot-welds spaced as recommended by manufacturer for duct pressure class.

12. Elbows and Bends:
a. Elbows and bends for rectangular ducts shall have centerline radius of 1-1/2 times duct width wherever possible. Elbows for grease exhaust and fume hood exhaust shall be full radius. Vanes or mitered duct are not allowed.
b. Where centerline radius is less than 1-1/2 times duct width (on supply, return and exhaust ductwork), elbows shall be radius throat (square throat allowed when turning around column or other close objects) with radius heel. For elbows whose width is greater than 48 inches and/or where shown on plans, provide splitter vanes. Install vanes in accordance with SMACNA. Where multiple elbows are separated by less than ten duct diameters use splitter (full length) vanes.
c. For round ductwork provide stamped elbows, with centerline radii equal to 1-1/2 times duct diameter, or gored elbows as follows:

Elbow Angle	No. of Gores
0° - 36°	2
37° - 72°	3
73° - 90°	5

d. Elbows for flat oval ducts shall have centerline radii equal to 1-1/2 times duct diameter in plane of bend, or gored elbows with gores as specified for round ducts.

13. Access Panels/Doors:
    a. Provide proper pressure and leakage rated, gasketed, duct mounted access panels/doors for the following items with minimum sizes, as indicated. Access doors shall be of double wall construction. Access doors in insulated ducts shall be insulated. Gauges of door materials, number of hinges, number and type of door locks shall be as required by the SMACNA Duct Construction Standards. Hinged doors are not acceptable, screwed or bolted access panels are not acceptable. Doors shall be chained to frame with a minimum length of 6" to prevent loss of door. For seal Class A, access doors shall be leakage rated, neoprene gasketed UL 94 HF1 listed, DUCTMATE "sandwich" or approved equal. Door metal shall be the same gauge as the attached duct material. For grease and high temperature ducts, door assembly shall be rated for 2300° F. The minimum sizes shall be:
        1) Manual volume dampers 2 sq. ft. and larger – 6" x 6" minimum.
        2) Inlet side to all coils – 12" x 12", or larger.
        3) Suction and discharge sides of inline fans – 24" x 24" minimum
        4) At additional locations indicated on Drawings, or specified elsewhere – 12" x 12" minimum.
        5) Generally access doors are not shown on the Drawings, but shall be provided in accordance with the above.

14. Extractors shall have adjusting rod and locknut on outside of duct.

15. Connections to roof fans:
    a. Shall be at least 22 gauge galvanized steel soldered watertight.
    b. Solder side seams at least 12" up from bottom.
    c. Provide suitable dielectric gaskets to join dissimilar materials.

16. Duct Pressure Tests:
    a. Pressure test ducts after takeoffs and wall penetrations are in place and before applying exterior insulation. Correct any leaks.
    b. Pressure and leak test 100% of low-pressure ductwork at 100% of operating system pressure. Duct shall be constructed so there is no joint or structural failure at the test pressure.

17. Duct Leakage Tests: Leak testing shall be per SMACNA HVAC Air Duct Leakage Test Manual. Provide orifice assembly including straightening vanes, orifice-plate mounted in straight tube with properly located pressure taps, and U-tube manometer or other device as specified by SMACNA. The orifice assembly shall be calibrated accurately and shall come with calibration curve. Leakage classes shall be as previously specified. Submit leak test report (per SMACNA format) for Architect review. Drawings of ductwork tested shall also be submitted with report, indicating presence of takeoffs, wall penetrations, joints, etc.

18. Materials:
    a. Sheetmetal ducts shall be constructed of hot-dipped galvanized sheetmetal with G90 Commercial coating according to ASTM 527 unless specified otherwise.
    b. Flexible Ductwork:

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1) Flexible duct connected to insulated or lined duct shall also be insulated and shall be equivalent to Wiremold Type WK or Flexmaster Types 2 or 4 (not type 9), with 1-1/2” 3/4 lb. density fiberglass insulation and an aluminized reinforced vapor barrier.
2) Submittals shall include data or number of polyester plies and minimum thickness of polyester core, in addition to other data listed above required to ensure that submitted product meets the requirements of these Specifications.
3) If flex duct other than the model numbers of the vendors listed above is submitted, a sample of the flex duct shall be submitted to the Architect. The Architect shall have sole discretion in determining whether the submitted flex duct is equivalent to that of the named vendors above.
4) Unless otherwise indicated, flexible duct shall not exceed 5’-0” long.

C. 2” and Lower Pressure Class Ductwork – Rectangular:

1. Ducts wider than 19” with more than 10 square feet of un-braced panel shall be beaded or cross-broken.

2. Internal stiffening struts shall only be used upon prior written approval of the Architect.

3. Make changes in duct size with tapered connections as required by SMACNA. Changes shall NOT exceed 30° from line of airflow. Take-off to the diffusers shall be 45° leading edge type or bellmouth type.

4. Transverse joints shall be TDF/TDC or slip joints; use flat or standing seam according to SMACNA. Where the duct size requires a standing seam but space restrictions dictate flat seam, notify Architect prior to fabrication.

D. 2” and Lower Pressure Class Ductwork – Round:

1. Joints:
   a. Longitudinal joints shall be spiral seam, butt welded, lap and seam welded, or ACME lock-grooved seam. Snap lock seams shall be used on 1/2" w.g. pressure class duct only.
   b. Transverse joints shall be beaded sleeve joint or other approved joints listed in SMACNA. Use three (3) or more sheetmetal screws at 15” uniform intervals along circumference of joints.

2. Branch fittings shall be conical tee (Buckley or equal) or combination tee as shown in SMACNA.

E. Flexible Duct:

1. Flexible ductwork shall be Flexmaster Triple-Lock Buck Duct Flexible Air Duct (insulated or non-insulated) as manufactured by Buckley Associates, ATCO, or equal. Flexible duct, non-insulated, shall be Underwriters Laboratory Listed UL 181 Class 0 air duct and constructed in accordance with NFPA Standards 90A and 90B. It shall have a smoke/flame spread rating of 50/25.

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2. The duct shall be made from a tape of dead soft aluminum sheet, spiral wound into a tube and spiral corrugated to provide strength and stability. The joint shall consist of a triple lock mechanically performed without the use of adhesives to make a durable airtight seam. A double lock is not acceptable.

3. Flexible duct connected to insulated or lined duct shall also be insulated. Flexmaster insulated flex shall have a gray Fire Retardant Polyethylene outer jacket with a 1/2 lb. density, 1-1/2" thick fiberglass insulation blanket, factory wrapped, providing a thermal performance of R-6 overall. Flexible Duct, insulated, shall be Underwriters Laboratory Listed and constructed in accordance with NFPA Standards 90A and 90B. It shall have a smoke/flame spread rating of 50/25.

4. The flexible duct shall be supported as required.

5. Flexible ductwork shall be rated at 12" positive pressure. Flexible ductwork from 3" to 16" in diameter shall have a negative pressure rating of 12".

6. All flexible ductwork shall be individually boxed and labeled for delivery to the jobsite for maximum protection.

7. Submittals shall include data on minimum thickness of aluminum core, in addition to other data listed above, required to ensure that submitted product meets the requirements of these Specifications.

8. Provide sealing compound for installation. See further paragraphs in this Specification and details for other installation requirements.

F. Volume Dampers:

1. Provide manually adjustable rectangular parallel blade dampers for duct heights less than 12" with factory-installed locking hand quadrants extended 2" for all dampers installed in externally insulated duct:
   a. On each supply, return and general duct take-off.
   b. At each take-off to register, grille or diffuser (not all are shown on Drawings for clarity).

2. Volume dampers shall be manufactured approximately 5/16" smaller in width and 1/8" smaller in height than size of duct in which they are installed; e.g., nominal damper size is 24" x 10"; actual size is approximately 23-11/16" x 9-7/8".

3. Volume damper frames shall be constructed of #6063 extruded aluminum reinforced channel with minimum thickness of 0.050". Opposed damper blades shall be #6063 extruded aluminum with minimum thickness of 0.050" and shall include reinforcing ribs. Each blade shall be supported in the damper frame by individual Teflon axle bearings, and shall be driven by stainless steel connecting slide linkage controlled by 3/8" square steel control shaft.

4. All required volume dampers may not be indicated on Drawings, but volume dampers shall be provided as necessary for systems balancing.

5. Where volume dampers are inaccessible, use locking type ceiling regulators and miter gear or worm gear for all horizontal dampers. Bearing coupling for bottom duct control may be used for shaft on vertical blade dampers. The 3/8" rod between ceiling regulator and damper shall be provided by Contractor.

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6. Damper blades shall be two gauges heavier than adjoining ductwork, and shall be riveted to supporting rods. Hem over edges parallel to rods.

7. Brackets shall be galvanized metal, secured to ductwork with sheetmetal screw with locking quadrant arms (see Seal Class Section for additional requirements). Provide 2” handle extension for all dampers on externally insulated ductwork.

8. Note: All required volume dampers may not be indicated on Drawings but dampers shall be provided as necessary for system balancing.

G. Diffusers, Registers and Grilles:

1. Provide diffusers, registers and grilles for supply, return and exhaust outlets, of size, type and design shown on Drawings. Acceptable manufacturers shall be Anemostat, Krueger, Metal*Aire, Price, or Titus.

2. Equipment shall be tested and rated per ASHRAE 91-70.

3. Equipment shall handle air quantities at operating velocities:
   a. With maximum diffusion within space supplied or exhausted.
   b. Without objectionable air movement as determined by Architect.
   c. With sound pressure level not to exceed NC 30.

4. Supply, return and exhaust outlets shall have opposed blade volume dampers operable from front.

5. Supply registers shall have two (2) sets of directional control blades.

6. Diffusers within same room or area shall be of same type and style to provide Architectural uniformity.

7. Diffusers, registers and grilles shall be furnished with gaskets and installed with faces set level and plumb, tightly against mounting surface.

8. Finish shall be as directed by the Architect.

9. Coordinate diffusers, registers and grilles with ceiling and wall construction. Refer to Architectural Drawings for exact lengths and for framing and mitering arrangements that may differ from those shown on HVAC Drawings.

H. Branch Duct Take-off Fittings:

1. Contractor shall provide bellmouth take-offs at all branch duct locations.

2. Bellmouth fitting shall be provided with damper.

3. Bellmouths shall be constructed of heavy-duty galvanized steel. Bellmouths shall include an airtight neoprene gasket to ensure a tight fitting with minimal leakage. Pre-drilled holes shall be provided for quick mounting.

4. Standard damper hardware to be constructed of 26-gauge galvanized material with a quadrant damper and tight-fitting gasket to ensure minimal leakage at damper pivot points.

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5. Optional heavy-duty hardware shall be provided at locations of higher static pressure where shown on the Drawings.

6. Ninety-degree (90°) take-offs are not permitted on this project.

2.2 DUCT INSULATION:

A. General:

1. Insulation shall be Certain-Teed, Knauf, Manville or Owens Corning. Install insulation, mastics, adhesives, coatings, covers, weather-protection and other work exactly as required by manufacturer's recommendations. Materials shall meet requirements of Adhesive and Sealant Council Standards and SMACNA.

2. Apply insulation after systems have been tested, proved tight and approved by Architect. Remove dirt, scale, oil, rust and other foreign matter prior to installation of insulation.

3. Leaks in vapor barrier or voids in insulation will not be accepted.

4. ASTM E-84 minimum fire hazard ratings shall be 25 flame-spread, 50 fuel contributed and 50 smoke developed.

5. Where ducts are insulated, flexible connections to ducts shall be insulated.

6. Insulate standing seams with same material and thickness as duct.

7. Acoustically lined ductwork shall not be insulated externally, except as noted otherwise.

8. Return ductwork in ceiling plenums shall not be insulated.

9. Insulation shall be continuous through wall and ceiling openings and in sleeves.

10. Transmission rates of vapor barriers shall not exceed 0.02 perms.

11. Do not insulate fibrous glass duct.

B. Concealed Rectangular, Flat Oval and Circular Ductwork:

1. Insulate supply and outside air ductwork and plena in concealed spaces and return ductwork not in ceiling plenum with glass duct wrap; with foil-Kraft flame-resistant vapor barrier.

2. Insulation shall provide a minimum R-8 value when located in unconditioned spaces and a minimum R-12 value when located outside the building.

3. If insulation does not have pre-cut lap, make lapped butt joints by cutting 2" strip of insulation away from vapor barrier. Apply 6" strips of approved adhesive on 16" centers and wrap duct with insulation. Staple lapped joint with outward-clinching staples. Seal stapled joints airtight with approved matching pressure-sensitive tape.

4. Cover breaks in vapor material with patches of same material, secured with adhesive and staples. Seal staples with approved pressure sensitive tape.

5. Fill voids in insulation at jacket penetrations and seal with pressure sensitive tape.

6. Seal and flash terminations and punctures with fibrous glass cloth between two (2) coats of pressure sensitive tape.

7. Terminate vapor barrier and extend insulation at standoff brackets.

2.3 PIPING AND FITTINGS

A. General: Pipe materials and fitting materials shall be as indicated in Schedule of Pipe and Fitting Materials.

B. Schedule of Pipe and Pipe Fitting Materials:

Service	Systems Description	Pipe Size	Pipe Material	Joints	Fitting Material	Fitting Rating PSI/Class/ Weight
Hot Water	HWS/R	2” and	Copper, B88, Type L	Soldered 95/5 Tin/Antimony or Press	Wrought copper, B16.22	Class 150
Refrigerant	R	All	Copper, ACR	Silver Brazed	Wrought Copper	200 PSI

C. Connections:

1. Provide dielectric fittings at connections of dissimilar materials.

2. Provide eccentric reducing couplings to bring pipes flush on top for water service and flush on bottom for steam service.

3. Branch lines in welded piping shall be made with welding tees except that branch lines less than one half diameter of main may be made with Weld-O-Lets or Sock-O-Lets.

4. Nipples shall be same material, make and thickness as pipe with which they are used. Close nipples shall not be used.

5. Make piping connections 2” diameter and smaller to valves and equipment with steel body, 300 psi brass seat unions on steel piping and with heavy semi-finished brass unions on copper tubing.

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6. Fit flanged joints with Johns-Manville or approved equal full-face gaskets. Flanges shall be faced and drilled to ASA standards and fitted with semi-finished hexagon machine bolts and nuts of proper number and size.

7. Make screw joints tight with Teflon (polytetrafluoroethylene) tape or litharge-glycerin mixture applied to male threads. Use tapered threads.

8. Make fusion welded joints as required by ANSI B31.1. Make changes in direction of pipe with welded fittings only. Bevel connections before welding, mechanically or by flame cutting.

2.4 VALVES AND STRAINERS

A. Valves on hot water services shall be 125 psi unless noted otherwise. Provide balancing valves where shown on Drawings.

B. Valves shall have name of manufacturer and guaranteed working pressure cast or stamped on bodies. Valves of similar type shall be by single manufacturer. Provide chain operators for valves 7 feet and higher above floor.

C. Provide bronze-body ball valves with reinforced Teflon seats, seals, bearings and packing. Ball valves shall be used for hot water services in sizes 2” and smaller. Do not use ball valves for balancing service. Valves on insulated piping shall have 2” extended stems. Valves shall be as manufactured by Apollo, Cannon, Nibco, Milwaukee or Watts. Valves shall be rated 600 psi W.O.G.

D. Check valves 2” and smaller shall be bronze, screwed ends, swing pattern. Check valves for hot water, shall be spring loaded, silent check, as manufactured by APCO, Milwaukee, Mueller or Stockham.

E. Strainers:

1. Strainers 2” and smaller shall be 250 lb. bronze body, stainless steel, screen with 20 mesh screen opening, Y-pattern, screwed ends, as manufactured by Sarco Type BT, Mueller, Watts or Armstrong.

2. Strainer gaskets shall not contain asbestos.

F. Provide threaded vacuum breakers with ball, spring, O-ring flexible seat and screen. Ball shall be 440 stainless steel; seat shall be EPR. Spring shall be 316 stainless steel, screen and cap shall be 304 stainless steel and threaded collar shall be 416 stainless steel. Body shall be brass. Vacuum breakers shall be as manufactured by Johnson Series VB8 size 1-1/4 IPS, or equivalent by Watts or ITT Hoffman.

G. Provide unions for threaded end valves to facilitate removal from pipe.

H. Automatic Flow Control Valves:

1. Provide automatic pressure compensating flow control valves by Griswold, or Auto-flow where indicated on the Drawings. Valves shall have the capacities and pressure differential characteristics, as indicated, and conform to the following Specifications. Valves 2” and smaller shall be threaded bronze.

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2. Valves shall be factory set and shall automatically limit the rate of flow to required engineered capacity within + 5% accuracy over an operating pressure differential of at least 14 times the minimum required for control.

3. The control mechanism of the valve shall consist of self-contained, open-chamber cartridge assembly with unobstructed flow passages that eliminate accumulation of particles and debris. All internal working parts shall be stainless steel or nickel-plated brass. Body shall be ductile iron, cast iron, or bronze.

4. The cartridge assembly shall consist of a spring-loaded cup. The cup shall utilize the full available differential pressure across the valve to actuate the cup and, thereby, reduce friction and hysteresis and eliminate binding.

5. Valves shall be available in minimum of three (3) pressure differential ranges, with the minimum range requiring less than 2 psig to control flow. Valve bodies shall be provided with inlet and outlet tapings suitable for connection of instruments for verification of flow rates and temperature and shall be marked to show direction of flow. Valve bodies shall be rated for use at not less than 150% of system designed operating pressures.

6. Certified performance data for the flow control valve, based on independent laboratory tests, supervised and witnessed by a Registered Professional Engineer, shall be available.

7. All flow control valves shall be supplied by a single source responsibility.

8. Each automatic flow control valve shall be furnished with a valve kit consisting of 1/4" x 2” minimum size nipples, quick-disconnect valves (to be located outside of insulation), and fittings suitable for use with the measuring instruments specified, as well as temperature.

9. Provide a metal identification tag, with chain, for each installed valve. The tag to be marked with zone identification, valve model number and rated flow in GPM.

10. Flow control valve shall be warranted for period of five (5) years from date of startup.

11. Provide Owner with dual hose meter kit including pressure gauge with 4-1/2” dial, 3-way push button operated valve, 5 foot long dual connection hoses, dual shutoff and vent valves, dual special valves for connection to standard valve kit, flow conversion chart and carrying case.

I. Combination Balancing/Flow Measurement/Shut-off Valves:

1. Valves shall be Y-pattern style with multi-turn hand-wheel.

2. Valves shall be capable of being installed in any direction without affecting flow measurement and shall provide the following functions:
   a. Precise flow measurement.
   b. Precision flow balancing.
   c. Positive shut-off with no drip seat.
   d. 3/4" drain port suitable for hose bib fitting. (Sizes 2” and below.)

3. Valves shall have four (4) 360° adjustment turns (2” and below). Hand-wheels shall have digital indicators with hidden memory and tamper-proof setting features.

4. Valves 2” and below shall be non-ferrous, pressure die-cast, non-porous Ametal copper alloy, with soldered ends.

5. Pressure ratings shall be 300 psi for 2” and below, 250 psi for flanged and 300 psi for grooves ends.

6. Each valve shall have pressure/temperature readout ports with EPDM seals and attached shut-off valves.

7. One (1) computerized hand-held balancing meter shall be furnished to the Owner. The Testing and Balancing Contractor shall utilize this instrument for his work. The meter shall include the following:
   a. Flow measurement direct in GPM.
   b. Differential pressure measurement.
   c. Temperature measurement.
   d. Automatic calibration.
   e. Automatic air pursing.
   f. Extended data logging functions.

8. Balance valves 2” and under shall be Tour and Anderson Model STAS. The hand-held meter shall be Tour and Anderson Model CBI with PCB data logging features. Balance valves manufactured by Armstrong or Victaulic shall be considered equivalent.

2.5 PIPE INSULATION

A. Insulation shall be fibrous glass insulation with factory-applied fire retardant vapor barrier jacket by Owens Corning, Certain-Teed, Manville or Knauf, installed as required by manufacturer. ASTM E-84 fire hazard ratings shall be 25 flame spread, 50 smoke developed and 50 fuel contributed.

B. Apply insulation after systems have been tested, proved tight and approved by the Architect. Remove dirt, scale, oil, rust and foreign matter prior to installation of insulation.

C. Provide fibrous dual temperature insulation with factory applied vapor barrier jacket on condensate drain piping, unless noted otherwise.

D. Drain piping shall have 1/2" thick insulation.

E. Insulation Table:

TABLE C403.2.8
Minimum Pipe Insulation Thickness (thickness in inches)[a]

Fluid Operating Temperature Range and Usage (°F)	Insulation Conductivity		Nominal Pipe or Tube Size (Inches)				
	Conductivity Btu – In./(h . ft^2 .	Mean Rating Temperature,	<1	1 to <1½	1½ to < 4	4 to < 8	< 8

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	°F)[b]	°F					
> 350	0.32 – 0.34	250	4.5	5.0	5.0	5.0	5.0
251 – 350	0.29 – 0.32	200	3.0	4.0	4.5	4.5	4.5
201 – 250	0.27 – 0.30	150	2.5	2.5	2.5	3.0	3.0
141 – 200	0.25 – 0.29	125	1.5	1.5	2.0	2.0	2.0
105 - 140	0.21 – 0.28	100	1.0	1.0	1.5	1.5	1.5
40 – 60	0.21 – 0.27	75	0.5	0.5	1.0	1.0	1.0
<40	0.20 – 0.26	75	0.5	1.0	1.0	1.0	1.5

1. For piping smaller than 1½ inch (38 mm) and located in partitions within conditioned spaces, reduction of these thicknesses by 1 inch (25 mm) shall be permitted (before thickness adjustment required in footnote b) but not to a thickness less than 1 inch (25 mm).
2. For insulation outside the stated conductivity range, the minimum thickness (T) shall be determined as follows:
   a. T = r (1 + t/r)K/k – 1) where:
      1) T = minimum insulation thickness,
      2) r = actual outside radius of pipe,
      3) t = insulation thickness listed in the table for applicable fluid temperature and pipe size,
      4) K = conductivity of alternate material at mean rating temperature indicated for the applicable fluid temperature (Btu x in/h x ft 2 x °F) and
      5) k = the upper value of the conductivity range listed in the table for the applicable fluid temperature.

F. Provide longitudinal lap and 6” wide vapor barrier joint seal strips secured with approved adhesive.

G. Seal ends of pipe insulation and seal insulation to pipe with approved fire retardant vapor barrier, at flanges, valves and fittings and at intervals of no more than 21 feet on continuous runs of piping.

H. Secure covers on concealed pipe with metal bands at least 3/4" wide and no more than 18” apart, spaced to hold ends and center of each section.

I. Insulation on Fittings, Valves and Flanges:

1. Fittings, valves and flanges shall be insulated with pre-cut, factory-supplied fibrous glass, by Certain-Teed, Knauf, Owens Corning or Manville.

2. Fittings, valves and flanges shall be insulated with same material and to same thickness as adjoining pipe insulation.

3. Pipe fittings shall be pre-tested, clean and dry before insulation.

4. Installation of insulation on fittings shall be as follows, in order:
   a. Wrap insulation around fitting and tuck ends into fitting throat.

b. Edges of adjacent insulation shall be tufted and tucked in, to fully insulate fitting to thickness of adjacent pipe insulation. Use two or more thicknesses if necessary.
c. If two layers of insulation are used on fittings, wrap and secure first layer with twine before applying second layer.
d. Top layer of insulation shall be covered with one (1) piece PVC, Zeston molded fitting cover. Secure cover with stainless steel tack fasteners inserted into jacket thread overlap seam.
e. Tape joints with pressure-sensitive vapor barrier tape; tape shall extend 2” on either side of joint.

5. For strainers and other valves or fittings which need maintenance, provide preformed removable insulation section.

J. Refrigeration Line Insulation:

1. Suction lines, hot bypass lines and outdoor liquid lines shall be insulated with 3/4" thick rigid closed cell foam insulation. Armstrong Rigid Armaflex, Manville, Owens Corning or Halstead/Nomaco (Insultube), except in computer room plena.

2. Installation shall meet manufacturer’s recommendations. Seal butt joints with insulation manufacturers approved adhesive.

3. Outside above ground insulation shall be protected with two (2) coats of approved vinyl lacquer coating over woven glass mesh adhered to insulation with Insulcolor or approved equal lagging adhesive, as recommended by manufacturer.

4. Refrigerant piping in hung ceiling and under floor supply and return plena shall be insulated with 1” thick fibrous glass insulation that meets applicable requirements of this paragraph.

5. VRF systems require all refrigerant lines to be insulated from the outdoor unit to the indoor terminal units.

2.6 PIPE HANGERS AND SUPPORTS

A. Provide pipe stands, supports, hangers and other supporting devices in accordance with ANSI B31.9 and MSS-69, as necessary to support work required by Contract Documents.

B. Secure vertical piping to building construction to prevent sagging or swinging.

C. Space hangers for horizontal piping as follows:

Pipe Size	Rod Diameter	Maximum Spacing
Up to 1-1/4”	3/8”	8 ft.-0”

D. Horizontal copper tubing shall have maximum hanger spacing of 5 ft. for tubing 1-1/4” diameter and smaller.

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E. Reduce spacing to a maximum of 10'-0" apart, regardless of pipe size, as necessary for fittings, valves and other concentrated loads.

F. Support piping 3" diameter and under from structure with Carpenter and Patterson Fig. 100 clevis hangers or approved equal.

G. Hangers shall be as manufactured by Carpenter and Patterson, F&S or Grinnell Co. Figure numbers of Carpenter and Patterson are specified to establish standards of quality for performance and materials.

H. Provide spring hangers with travel stops as specified in Vibration Isolation Paragraph, where necessary and where shown on Drawings.

I. Insulated pipe shall have 12", 14 ga. shields at hangers, composed of 180° coverage of galvanized sheetmetal and high density, preformed rigid insulation. Where rollers are required, shield shall be steel pipe.

J. Hangers for horizontal lines shall be vertically adjustable to obtain pitch requirements of Piping Paragraph.

2.7 SLEEVES AND PENETRATIONS

A. Pipe Sleeves:

1. Sleeves through floors and through exterior, structural and fire-rated construction shall be hot-dipped galvanized Schedule 40 steel pipe.

2. Sleeves through partitions and non-rated construction shall be 26-gauge galvanized steel with lock longitudinal seams, or approved plastic pipe.

3. Provide waterproofing membrane locking devices at floors. Provide 150 lb. slip-on welding flanges at exterior wall penetrations.

B. Duct Sleeves and Openings:

1. Sleeves through floors, through exterior structure, through fire-rated construction and through smoke partitions that require smoke dampers shall be Schedule 40 galvanized steel pipe for round duct and shall meet the SMACNA Fire Damper and Heat Stop Guide for rectangular ducts. Fireproof packing shall be applied to seal any openings between sleeve and wall. Materials shall maintain the fire rating of the wall, and shall be installed in accordance with the SMACNA Fire Damper and Heat Stop Guide.

2. Openings in walls, partitions and other fire-rated construction that do not require smoke dampers shall meet NFPA 90A, Section 3-3.8.

3. Materials for prepared openings in partitions shall match construction penetrated.

C. Pipe Sleeve Packing:

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1. Packing between the pipe and the sleeve (or wall or slab opening) in fire-rated walls or slabs shall be a combination of fireproof insulation and fireproof caulk. The combination of materials shall have the same fire rating, in hours, as the wall or slab, as tested in accordance with the latest edition of ASTME-814 (UL 1479). The combination of materials shall be classified by UL, (fill, void or cavity materials) for the fire rating required and shall be listed as a numbered system in the UL Fire Resistance Director. Fiberglass shall not be used as the insulation material.

2. Acceptable fireproof insulation materials shall be: Kaolin (Kaowool by Babcock and Wilcox); ceramic fiber blanket (Fiberfrax by Standard Oil) or fire-rated material wool (Thermafiber by USG). Acceptable fireproof caulks shall be: Silicone (Firestop by Dow Corning, Hilti CS240); ceramic fiber (Fyreputty by Standard Oil) or intumescent synthetic elastomer (Fire Barrier Caulk by 3M, Hilti CS2420).

3. Packing for sleeves that do not require maintenance of fire rating shall be oakum, silicate foam, ceramic fiber or mineral fiber with approved sealant. Pack or foam to within 1” of both wall surfaces. Seal penetration packing with approved caulking and paintable waterproof mastic surface finish or silicone caulking.

4. All materials must be installed in accordance with manufacturer’s instructions; all gaps must be sealed. Finish caulk flush with wall or slab surface if piping runs exposed.

D. Other Waterproof Pipe Penetrations:

1. Modular mechanical penetration seals shall be interlocking synthetic rubber links shaped to fill annular space continuously, with galvanized carbon steel bolts, nuts and pressure plates to expand rubber seal between pipe and sleeve. Sleeve seal shall be watertight.

2. Prefabricated modular sleeves shall be Mason Industries (SWS) or approved equal stiffened galvanized steel sleeves with preformed closed-cell elastomeric seal (non-fire-rated) or preformed mineral fiber or silicone seal (fire-rated).

3. Provide waterproof 1” single ring set in silicone and bolted to floor or wall at chipped and drilled penetrations of existing slabs-on-grade and existing walls-below-grade.

2.8 ESCUTCHEONS AND DUCT COLLARS

A. Provide adjustable escutcheons on exposed piping that passes through finished floors, walls and ceilings. Escutcheons shall be chromium-plated cast brass, sized to cover sleeve opening and to accommodate pipe and insulation.

B. Provide 4” wide, 20 gauge galvanized sheetmetal collars at sleeves and prepare openings, sized to cover entire duct penetration including sleeve and seal, and to accommodate duct and insulation as necessary. Edges shall have milled lips ground smooth. Paint to match finish of duct or as directed by the Architect.

C. Provide #316 stainless steel/No. 4 finish collar for emergency generator exhaust piping which passes through exterior wall.

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2.9 MOTORS, STARTERS AND WIRING

A. Provide motors and controls, and furnish starters for HVAC equipment, except units served by MCC provided under Section 26 00 00 – ELECTRICAL WORK. Provide control and other related wiring including interlocks. Power wiring (to panelboards, disconnect switches, starters and motors) will be provided under Section 26 00 00 – ELECTRICAL WORK. Starters that are not integral to equipment will be furnished, installed and wired under Section 16100 – ELECTRICAL WORK.

B. Unless otherwise specified, motors shall be NEMA Design B, constant speed, self-ventilated squirrel cage induction. Motors shall have 1.15-service factor unless totally enclosed. Motors shall have Class B insulation.

1. Motors 1/2HP and over shall be as required in schedules.

C. All motors shall be high or premium efficiency type. They shall conform to NEMA Standard MG-1-12.53a and shall have their efficiencies determined in accordance with IEEE Standard 112 Method B. The NEMA nominal efficiency shall be listed on the motor nameplate. Minimum nominal efficiencies shall be as follows:

Size (HP)	Nominal Efficiency (Minimum)
1 – 3	84%
5 – 7-1/2	88.5%
10 – 25	90%
30 –100	93%
100+	95%

D. Starters that require interlocks or remote control shall be magnetic with HAND-OFF-AUTOMATIC switch in cover. Provide magnetic starters as necessary, with auxiliary contacts, buttons and switches in required configurations. Refer to paragraph AUTOMATIC TEMPERATURE CONTROLS and to Drawings for interlock requirements. Starters shall be as manufactured by one of the following manufacturers: Cutler-Hammer, Clark, Arrow Hart, or Square D.

1. Each 3-phase, 60 Hz motor shall be provided with magnetic starter with either ON-OFF push button or hand-off-automatic switch.

2. Other motors shall be provided with a manual starter with ON-OFF switch.

3. Control relay for each starter shall be for operation on 120 V, single-phase, and transformer of sufficient capacity within starter case shall be furnished for this purpose.

4. Provide inverse time limit overload and under voltage protection in each leg and with pilot lights. Provide “red” and “green” On-Off pilot lights.

5. Provide nameplates with engraved “white” lettering to designate area and equipment served.

6. Starters for refrigeration machines shall be furnished by Unit Manufacturer.

7. Provide starters for two-speed motors with deceleration relay.

8. Furnish for all single speed motors, 25 HP and above, 95% power factor correction capacitors. Capacitors shall be in NEMA enclosure of the same rating as the motor's starter.

2.10 CABINET UNIT HEATERS (HOT WATER)

A. General: Provide hot water cabinet style fan-forced unit heaters in the sizes and capacities listed on the drawings scheduled. Units shall be as manufactured by Sterling, Trane, Airedale, or an approved equal.

B. Typical Construction:

1. All units shall be complete with 16 gauge front panel, 18 gauge ends, tops and internal casing of electro galvaneal steel.

2. Hot water coil shall have 1-1/4" copper tube stub ends.

3. Permanent split capacitor type motor shall be rated for 115 volts, 1-phase at the horsepower's indicated on the schedules.

4. Blowers shall be centrifugal type forward curved double width with galvanized fan wheel and galvanized fan housing.

5. Variable speed fan control via a solid state speed control switch shall be standard.

6. Completely removable and washable aluminum mesh screen filter shall be standard.

7. Piping and valve compartments shall be fully accessible through front of each unit by removing the front cover. Inlet and outlet grilles shall be stamped/louvered style.

8. A baked enamel eggshell finish shall be suitable of field re-painting. Units shall be provided with a color to be selected by the architect through the submittal process.

C. Controls and Features:

1. Units shall be furnished with return air temperature controller which will cycle the unit blower if the return temperature is too low. The blower shall shut down when the thermostat is satisfied. Thermostat shall have a minimum adjustable range between 55-175°F.

2. Limited access fasteners for front panel removal shall be available for all new units. A special tool will be required for opening the panels.

2.11 CENTRIFUGAL FANS

A. Provide centrifugal fans by Chicago, Cook, Trane, ILG, Barry, Greenheck, New York Blower with welded steel housing and wheel, balanced dynamically and statically. Fans shall be AMCA-certified and sealed.

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B. Backdraft dampers shall not be provided when fans are specified or scheduled to be equipped with automatic control dampers in or immediately below curb.

C. Provide V-belt, variable-pitch drives for + 10% speed variation and with spring loaded belt tensioner.

D. Fans shall have centrifugal with backward-curved blades fan connected to electric motor so selected that in no instance can fan motor be overloaded at capacities shown on schedule on Drawings. Provide open drip-proof motor on adjustable base. Motors shall be high or premium efficiency type. See “Motors and Starters” paragraph of this specification for required efficiencies and other requirements.

E. Provide V-belt (direct) drives sized as recommended by manufacturer. Belt construction shall be rubber and cord. Belt sets shall be matched for length. Belt capacity shall be 150% of motor horsepower rating. Sheaves shall be cast and machined iron or steel larger than minimum diameters recommended for particular belt. Sheaves shall be balanced dynamically and statically.

F. Provide belt guards of 18 gauge steel mesh or perforated or expended steel sheets with angle frames and galvanized steel or iron trim, rigidly-braced. Provide ports for tachometer speed measurements at fan shafts.

G. Provide spring vibration isolation bases as shown on Drawings and specified in Vibration Isolation Paragraph.

H. Provide variable inlet vanes.

2.12 SPLIT SYSTEM DIRECT EXPANSION AIR CONDITIONING

A. Provide complete DX system for central station air conditioning units of types, sizes and capacities shown on schedules. System shall consist of matching air cooled condensing units, compressors, piping, controls, wiring and other accessories and appurtenances necessary to provide fully automatically functioning system.

B. Condenser coil shall be aluminum plate fins, mechanically bonded to seamless copper tubes, circuited for sub-cooling. Provide propeller fans arranged for vertical discharge. Condenser fan motors shall have inherent protection and shall be permanently-lubricated and resiliently-mounted. Fans shall have safety guards. Provide controls for cycling fans.

C. Compressors shall be serviceable hermetic with external spring isolators and automatically reversible oil pump.

D. Compressor shall unload in response to suction pressure in steps for partial load operation. Compressor shall be separated from condenser fans and coil.

E. Multiple compressor units shall have stop-start fans and coils. Compressor motors shall have part-winding start.

F. Provide factory-wired controls in separate enclosure. Safety devices shall consist of high and low pressure switching and compressor overload devices. Wiring shall incorporate positive acting timer to prevent short cycling of compressor if power is interrupted. Time shall prevent compressor from restarting for approximately 5 minutes after shutoff. Units shall have transformer control circuit.

G. Casing shall be galvanized steel finished with baked enamel. Provide service access panel.

H. Provide openings for power and refrigerant connections.

I. DX air conditioning system be capable of starting and operating down to 0° F ambient. Low ambient operation shall be accomplished by varying the speed of condenser fan based on sensing of head pressure in refrigerant liquid line, by modulating damper in condenser fan discharge based on refrigerant head pressure sensing, or by flooding the condenser coil with liquid refrigerant to maintain the desired condenser pressure. Low ambient systems with cycle fans or modulate dampers based on ambient temperature exclusively, are unacceptable. Provide time delay rate for timed bypass of the low pressure switch or other means to start condensing at

0° F without nuisance safety trip units. Any field installation and control wiring of low ambient operation components shall be performed under the work of the mechanical section according to equipment manufacturer's instructions. If condensing unit does not come with hot gas bypass pre-piped, provide under the work of the mechanical section all components necessary for hot gas bypass operation. Hot gas system shall be piped in strict accordance with recommendations of condensing unit manufacturer. Submit with Shop Drawings showing refrigerant piping, hot gas piping layout including bypass pipe sizes and connection locations, hot gas bypass valve and solenoid valves manufacturers and model numbers, sensing capillary bulb locations, control wiring of solenoid and details of any other components. Adjust hot gas bypass in field, as required, to maintain proper system operation.

J. Provide refrigerant piping between air-cooled condensing unit and AC unit. Provide necessary auxiliaries and appurtenances, such as strainer, sight glass, oil trap, scale trap and other devices, to make system complete and operable under fully automatic control. Refrigeration piping shall be ACR copper tubing made up with wrought copper fittings using silver solder, installed with nitrogen charge while soldering; of sizes as recommended by manufacturer of air conditioning unit and matching air-cooled unit. Piping shall meet requirements of Piping and Valves paragraphs of this Section.

K. Provide back-seating globe stop valve, winged and sealed. Cap valves 1" and under shall be diaphragm setting.

L. Tests as specified in PART 3.

M. Provide supports, hangers and other appliances necessary to support refrigeration system and air-cooled units.

2.13 SEQUENCE OF OPERATIONS

A. Exhaust Fans: Exhaust fans are started and stopped based on a time of day schedule set via a time-clock. On a call to start, respective dampers (where applicable) will open and fan will be energized.

B. Finned Tube Radiation: A wall-mounted thermostat maintains constant space temperature by opening/closing the control valve. Isolation control valves on both the supply and return are closed during the cooling season to prevent condensation.

C. Cabinet Heaters: A wall-mounted thermostat maintains constant space temperature by cycling the unit mounted fan. Isolation control valves on both the supply return are closed during the cooling season to prevent condensation.

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D. VRF Refrigerant Flow System: The unit manufacturer shall provide controls to maintain space temperature. Each indoor unit shall be controlled by a hard wired, wall mounted thermostat. The system controller shall tie the outdoor unit and the indoor air handling units. The software shall be installed and programmed. The system shall be configured, monitored, and adjusted via the use of the system controller.

PART 3 EXECUTION

3.1 SPECIAL RESPONSIBILITIES

A. Coordination: Cooperate and coordinate with work of other Sections in executing work of this Section.

1. Perform work such that progress of entire project including work of other Sections shall not be interfered with or delayed.

2. Provide information as requested on items furnished under this Section which shall be installed under other Sections.

3. Obtain detailed installation information from manufacturers of equipment provided under this Section.

4. Obtain final roughing dimensions or other information as needed for complete installation of items furnished under other Sections or by Owner.

5. Keep fully informed as to shape, size and position of openings required for material or equipment to be provided under this and other Sections. Give full information so that openings required by work of this Section may be coordinated with other work and other openings and may be provided for in advance. In case of failure to provide sufficient information in proper time, provide cutting and patching or have same done, at own expense and to full satisfaction of Architect.

6. Provide information as requested as to sizes, number and locations of concrete housekeeping pads necessary for floor-mounted vibrating and rotating equipment provided under this Section.

7. Notify Architect of location and extent of existing piping, ductwork and equipment that interferes with new construction. In coordination with and with approval of Architect, relocate piping, ductwork and equipment to permit new work to be provided as required by Contract Documents. Remove non-functioning and abandoned piping, ductwork and equipment as directed by Architect. Dispose of or store items as requested by Architect.

B. Installation Only Items:

1. Where this Contractor is required to install items which it does not purchase, it shall coordinate their delivery and be responsible for this unloading from delivery vehicles and for their safe handling and field storage up to the time of installation. This trade shall be responsible for:
   a. Any necessary field assembly and internal connections, as well as mounting in place of the items, including the purchase and installation of all dunnage supporting members and fastenings necessary to adapt them to architectural and structural conditions.

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b. Their connection to building systems including the purchase and installation of all terminating fittings necessary to adapt and connect them to the building system.

2. This Contractor shall carefully examine such items upon delivery. Claims that any of these items have been received in such condition that their installation will require procedures beyond the reasonable scope of work of this Contractor will be considered only if presented in writing within one (1) week of their date of delivery. Unless such claims have been submitted this Contractor shall be fully responsible for the complete reconditioning or replacement of the damaged items.

C. Maintenance of equipment and Systems: Maintain HVAC equipment and systems until Final Acceptance. Ensure adequate protection of equipment and material during delivery, storage, installation and shutdown delays pending final test of systems and equipment because of seasonal conditions. Do not use boilers before providing water treatment where required; this includes use of boilers for temporary heat or for testing.

D. Use of Premises: Use of premises shall be restricted as directed by Architect and as required below:

1. Remove and dispose of dirt and debris, and keep premises reasonably clean. Upon completion of work, remove equipment and unused material. Put building and premises in neat and clean condition and do cleaning and washing required to provide acceptable appearance and operation of equipment, to satisfaction of Architect and as specified under CLEANING paragraph.

2. It shall be this trade's responsibility to store his material in a manner that will maintain an orderly clean appearance. If stored on-site in open or unprotected areas, all equipment and material shall be kept off the ground by means of pallets or racks, and covered with tarpaulins.

3. Do not interfere with functions of existing sewers and gas mains. Extreme care shall be observed to prevent debris from entering ductwork. Confer with Architect as to disruption of heating services or other utilities due to testing or connection of new work to existing. Interruption of heating services shall be performed at time of day or night deemed by Architect to provide minimum interference with normal operation. Obtain Architect's approval of the method proposed for minimizing service interruption.

E. Surveys and Measurements:

1. Base measurements, both horizontal and vertical, on reference points established by Contractor and be responsible for correct laying out of work.

2. In event of discrepancy between actual measurements and those indicated, notify Architect in writing and do not proceed with work until written instructions have been issued by Architect.

3.2 MATERIALS AND WORKMANSHIP

A. Work shall be neat and rectilinear. Ductwork and piping shall run concealed except in mechanical rooms and areas where no hung ceiling exists. Install material and equipment as required by manufacturers. Installation shall operate safely and without leakage, undue wear, noise, vibration, corrosion or water hammer. Work shall be properly and effectively protected, and pipe and duct openings shall be temporarily closed to prevent obstruction and damage before completion.

1. Except as specified otherwise, material and equipment shall be new. Provide supplies, appliances and connections necessary for complete and operational installation. Provide components required or recommended by OSHA and applicable NFPA documents.

2. References to manufacturers and to catalog designation are intended to establish standards of quality for materials and performance but imply no further limitation of competitive bidding.

3. Finish of materials, components and equipment shall be as approved by Architect and shall be resistant to corrosion and weather as necessary.

4. Owner will not be responsible for material and equipment before testing and acceptance.

3.3 CONTINUITY OF SERVICES

A. Do not interrupt existing service without Owner's approval.

B. Schedule interruptions in advance, according to Owner's instructions. Submit, in writing, with request for interruption, methods proposed to minimize length of interruption.

C. Interruptions shall be scheduled at such times of day and work so that they have minimal impact on Owner's operations.

3.4 TAGS

A. Upon completion of work, attach engraved laminated tags to all valves (listed in the valve directory called for in the "Bulletins, Manuals and Instructions" paragraph of these Specifications) and all pieces of HVAC equipment (including but not limited to pumps, fans, air handlers, coils and all other equipment listed in the HVAC Schedules). Valve tags shall have black characters on white face, consecutively numbered and prefixed by letter "V". Equipment tags shall have black characters on white face with labels corresponding to drawing schedule numbers.

B. Embossed or engraved aluminum or brass tags may be substituted if desired. Tags shall be at least 1/8" thick.

C. Valve tags shall be at least 1" in diameter with numerals at least 3/8" high and attached by "S" hooks or chains. Equipment tags shall be at least 2" diameter securely attached to apparatus.

D. Provide manufacturers equipment nameplates, catalog numbers and rating identification securely attached to electrical and mechanical equipment with screws or rivets. Adhesives or cements will not be permitted.

3.5 PIPE AND DUCT IDENTIFICATION

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A. Ductwork shall be stenciled at each junction or branch takeoff, at least once in each room, and at intervals not longer than 20 feet. Stencil shall clearly identify duct service ("S" for supply; "R" for return' "X" for exhaust), area served by branch, and arrow indicating direction of flow.

B. Provide color-coded pipe identification markers on piping installed under this Section. Pipe markers shall be snap-on laminated plastic protected by clear acrylic coating. Pipe markers shall be applied after architectural painting where such is required.

C. Provide arrow marker with each pipe content marker to indicate direction of flow. If flow can be in either direction, use double-headed arrow marker.

D. Mains shall be labeled at points of entrance and exit from mechanical room, adjacent to each valve, on each riser, at each tee fitting, at points of entrance and exit from building, at least once in each room and at intervals no longer than 20 feet.

E. Size of legend letters on markers and length of color field shall be per the latest edition of ANSI A13.1.

F. Markers shall be "Setmark" by Seton Name Plate Corp., or approved equal.

G. Following color-coding shall be used with names in black letters on background and while letters on green background:

Service	Legend	Background Color
Hot Water Supply	HWS	Yellow
Hot Water Return	HWR	Yellow
Condensate	CW	Yellow

H. Color banding shall meet latest edition of ANSI A13.1 and OSHA.

3.6 ACCESS AND ACCESS PANELS

A. Provide proper access to materials and equipment that require inspection, replacement, repair or service and coordinate their delivery with the installing Trade. If proper access cannot be provided, confer with Architect as to best method of approach for minimizing effect of reduced access which may result.

B. Coordinate and prepare a location, size and function schedule of access panels required to fully service equipment and deliver to a representative of the installing Trade. Furnish and install distinctively colored buttons (color as selected by Architect) in finished ceiling to identify all access panels.

C. Furnish access panels for installation under other Sections where fire dampers, volume dampers, controls, shut-off valves, control valves, check valves or other items installed under this Section require access and are concealed in floor, wall, furred space or above ceiling. Access panels shall be by Milcor, Knapp, Nystrom or Inland Steel; coordinate selection with other Sections supplying similar access panels.

D. Ceilings consisting of lay-in or removable splined tiles do not require access panels and dampers, splitters or test hole openings above ceiling shall have location marked with thumb tack on finished ceiling panel. Location shall be noted on record Drawings.

E. Access panels shall have same fire-rating classification as surface penetrated.

F. Panels shall be at least 12” x 12”; access panels at equipment (VAV boxes, fan boxes and others) shall be 18” x 18”.

3.7 PENETRATIONS AND SLEEVES

A. General:

1. Provide pipe and duct sleeves and packing materials as specified and as shown on Drawings at penetrations of foundations, walls, slabs (except on-grade), partitions and floors. Sleeves shall meet NFPA-101 requirements and materials requirements of PART 2 or this Section.

2. Coordinate work carefully with architectural and structural work. Set sleeves in forms before concrete is poured. Provide core drilling as necessary if walls are poured, or otherwise constructed, without sleeves and a wall penetration is required. Provide core drilling as required for penetrations of existing construction. Do not penetrate structural members without Architect’s approval.

3. Sleeves for insulated pipe and duct in non-fire rated construction shall accommodate continuous insulation without compression. Sleeves and/or penetrations in fire-rated construction shall be packed with fire-rated material which shall maintain the fire rating of the wall. Seal ends of penetrations to provide continuous vapor barrier where insulation is interrupted. See “PART 2” of these Specifications for requirements for packing materials.

4. Sleeves through floor shall be water-tight and shall extend 2” above floor surface.

B. Pipe Sleeves:

1. Annular space between pipe and sleeve shall be at least 1/4".

2. Sleeves are not required for slabs-on-grade unless specified otherwise.

3. Sleeves and packing materials, through rated fire walls and smoke partitions shall maintain fire rating of construction penetrated.

4. Do not support piping risers on sleeves.

C. Duct Sleeves and Prepared Openings:

1. Provide duct sleeves for round ducts 15” and smaller, and for square, rectangular and flat oval ducts, except as specified otherwise. Sleeves shall met SMACNA requirements.

2. Provide sleeves for ducts through 1, 2, or 3-hour fire-rated construction and smoke partitions, regardless of size and shape of ducts. Sleeves shall maintain fire rating of construction penetrated. Sleeve and seal materials, construction and clearances shall meet requirements of SMACNA Fire Damper and Heat Stop Guide for Air Handling Systems.

3. Prepared openings shall be framed to provide 1” clearance between framing and duct or duct insulation.

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D. Installation Testing, Listings and Approvals:

1. Installation shall meet material manufacturer's recommendations exactly, particularly as regarding safety, ventilation, removal of foreign materials and other details of installation. Dam openings as recommended. Remove flammable materials used for damming and forming seals in fire-rated construction.

2. Sleeve penetration methods shall be water and gas-tight and shall meet requirements of ASTM E-119 Standard Methods of Fire Tests of Building Construction and Materials.

3. Fire-stop penetration seal methods and materials shall be FM-approved and UL-listed as applicable.

4. Inspect foamed sealants to ensure manufacturer's optimum cell structure and color ranges.

3.8 ANCHORS AND INSERTS

A. Inserts shall be iron or steel of type to receive machine bolt head or nut after installation. Inserts shall permit adjustment of bolt in one (1) horizontal direction and shall develop strength of bolt when installed in properly cured concrete.

B. Provide anchors as necessary for attachment of equipment supports and hangers.

3.9 INSTALLATION OF EQUIPMENT

A. Avoid interference with structure and with work of other trades, preserving adequate headroom and clearing doors and passageways to satisfaction of Architect and in accordance with code requirements. Installation shall permit clearance for access to equipment for repair, servicing and replacement.

B. Install equipment so as to properly distribute equipment loads on building structural members provided for equipment support under other Sections. Roof-mounted equipment shall be installed and supported on structural steel provided under other Sections.

C. Provide suspended platforms, strap hangers, brackets, shelves, stands or legs as necessary for floor, wall or ceiling mounting of equipment provided under this Section (e.g. heating and ventilating units, fans, ducts and piping) as indicated on Drawings and in Specifications.

D. Provide steel supports and hardware for proper installation of hangers, anchors, guides, etc.

E. Provide cuts, weight and other pertinent data required for proper coordination of equipment support provisions and installation.

F. Structural steel and hardware shall conform to Standard Specifications of ASTM; use of steel and hardware shall conform to requirements of Section 5 of Code of Practice of American Institute of Steel Construction.

G. Verify site conditions and dimensions of equipment to ensure access for proper installation of equipment without disassembly which will void warrantee. Report in writing to Architect, prior to purchase or shipment of equipment involved, on conditions which may prevent proper installation.

3.10 CLEANING

A. Ductwork:

1. New ductwork shall be shipped from the shop to the job site with the ends of the ducts sealed tight with heavy duty plastic to prevent dirt, water or other elements from entering the ducts while in transport to the job site.

2. At the end of each working day all open ends of ducts that have been hung in place shall be re-covered with the plastic material to prevent the entry of foreign objects, dirt or debris into the ducts.

3. All ducts shall be cleaned of dirt and any other foreign matter if it should accumulate on or in the ducts prior to start-up and testing of the new HVAC systems. If the ducts do need to be blown clean, cheesecloth shall be placed over the outlet air openings, and the rooftop unit(s) serving the ducts shall be provided with temporary filters.

B. Piping:

1. Furnish pipe cleaning chemicals, chemical feed equipment, materials and labor necessary to clean piping.

2. Permanently install necessary chemical injection fittings complete with stop valves.

3. After chilled water, heating hot water, condenser water, steam and condensate piping have been pressure tested and approved for tightness, clean and flush piping specified under WATER TREATMENT paragraph.

4. Maintain continuous blow-down and make-up, as required during flushing operation.

5. Equipment: After completion of project, clean the exterior surface of equipment included in this section, including concrete residue.

3.11 STARTUP, TESTING, ADJUSTING AND BALANCING FOR HVAC

A. General:

1. References:
   a. AABC – National Standards for Total System Balance.
   b. ADC – Test Code for Grilles, Registers, and Diffusers.
   c. ASHRAE 111 – Practices for Measurement, Testing, Adjusting, and Balancing of Building Heating, Ventilating, Air Conditioning and Refrigeration Systems.
   d. NEBB – Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems.
   e. SMACNA – HVAC Systems Testing, Adjusting, and Balancing.

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2. Qualifications:
   a. Agency: Company specializing in the testing, adjusting, and balancing of systems specified in this section with minimum three years documented experience certified by AABC. Any of the following agencies shall be considered acceptable to perform the work of this section:
      1) Design Flow Associates, LLC
      2) J.F. Coffey and Associates, Inc.
      3) Kevin S. Cox Associates, Inc.
      4) American Test and Balance, Inc.
      5) Milarmer Associates, Inc.
   b. Perform work under supervision of AABC Certified Test and Balance Engineer or NEBB Certified Testing, Balancing and Adjusting Supervisor.

B. Examination:

1. Verify that systems are complete and operable before commencing work. Ensure the following conditions:
   a. Systems are started and operating in a safe and normal condition.
   b. Control systems are installed complete and operable.
   c. Proper thermal overload protection is in place for electrical equipment.
   d. Ductwork systems:
      1) Final filters are clean and in place. If required, install temporary media in addition to final filters.
      2) Duct systems are clean of debris.
      3) Fans are rotating correctly.
      4) Dampers are in place and open.
      5) Air coil fins are cleaned and combed.
      6) Access doors are closed and duct end caps are in place.
      7) Air inlets and outlets are installed and connected.
      8) Duct system leakage is minimized.
   e. Piping systems:
      1) Hydronic systems are flushed, filled, tested and vented.
      2) Pumps are rotating correctly.
      3) Proper strainer baskets are clean and in place.
      4) Service and balance valves are open.

2. Submit field reports. Report defects and deficiencies noted during performance of services which prevent system balance.

3. Beginning of work means acceptance of existing conditions.

C. Preparation:

1. Provide instruments required for testing, adjusting, and balancing operations. Make instruments available to Owner to facilitate spot checks during testing.

2. Provide additional balancing devices as required.

D. Installation Tolerances:

1. HVAC Systems: Adjust to within plus or minus 10 percent of design for supply and return systems and plus or minus 10 percent of design for exhaust systems.

2. Air Outlets and Inlets: Adjust outlets and inlets in space to within plus or minus 10 percent of design.

3. Hydronic Systems: Adjust to within plus or minus 10 percent of design.

E. Adjusting:

1. Ensure recorded data represents actual measured or observed conditions.

2. Permanently mark settings of balancing devices allowing settings to be restored. Set and lock memory stops.

3. After adjustment, take measurements to verify balance has not been disrupted or that such disruption has been rectified.

4. Leave systems in proper working order, replacing belt guards, closing access doors, closing doors to electrical switch boxes, and restoring thermostats to specified settings.

F. Sequencing:

1. All systems providing both heating and cooling shall be balanced in both modes of operation.

2. For all systems provide initial balancing to tolerances indicated in this section. After initial balancing readjust systems as directed by engineer and owner as necessary to achieve uniform space temperatures free from objectionable drafts and noises.

G. Air System Procedure:

1. Adjust equipment and distribution systems to provide required or design air quantities.

2. Make air quantity measurements in ducts by Pitot tube traverse of entire cross sectional area of duct.

3. Measure and record air quantities at air inlets and outlets.

4. Use volume control devices to regulate air quantities only to extent that adjustments do not create objectionable air motion or sound levels. Adjust air volume by adjusting duct internal devices such as dampers and splatters. Do not utilized opposed blade dampers at air inlets and outlets.

5. Vary total system air quantities by adjusting sheave position or replacing fixed sheaves with larger or smaller diameter sheaves at each fan. Provide replacement fixed ratio sheaves and belts after final balancing selected to achieve design airflows. Vary branch air quantities by damper regulation.

6. Measure and record static air pressure conditions at air supply and exhaust units, including filter and coil pressure drops, and total pressure across the fan. Make allowances for 50 percent loading of filters.

7. Adjust settings and minimum setpoints for motorized and backdraft dampers to design conditions.

8. Measure and record temperature conditions across dampers to check leakage.

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9. Balance variable volume systems at maximum air flow rate, full cooling, and at minimum air flow rate, full heating.

10. Measure and record building static pressure and adjust supply, return, and exhaust air systems to provide required relationship between each to maintain approximately 0.05 inches (12.5 Pa) positive static pressure near the building entries.

11. For variable air volume system powered units set volume controller to air flow setting indicated. Confirm connections properly made and confirm proper operation for automatic variable air volume temperature control.

12. Measure and record inlet and outlet temperatures at each air supply unit at full cooling and heating capacity.

13. Prepare system pressure profiles: On schematic fan system diagrams, show STATIC pressure readings taken at following points.
    a. Fan discharge
    b. Fan discharge plenum or main duct in fan room
    c. Fan inlet plenum
    d. Inlet and outlet plenum space on each side of each heating coil, cooling coil and filter
    e. Return air/outside air mixing plenum
    f. Duct or plenum immediately behind outside air louver
    g. Return/exhaust fan inlet
    h. Return/exhaust fan outlet
    i. Each main branch duct takeoff at each floor
    j. Within 3 feet of last supply air outlet connection in most remote duct.

14. Check multi-zone units for cooling, then heating, then modulating.

15. On fan powered VAV boxes, adjust air flow switches for proper operation.

H. Water System Procedure:

1. Adjust water systems to provide required or design quantities.

2. Use calibrated Venturi tubes, orifices, or other metered fittings and pressure gages to determine flow rates for system balance. Where flow metering devices are not installed, base flow balance on temperature difference across various heat transfer elements in the system.

3. Adjust systems to provide specified pressure drops and flows through heat transfer elements prior to thermal testing. Perform balancing by measurement of temperature differential in conjunction with air balancing.

4. Balance systems with automatic control valves fully open to heat transfer elements.

5. Balance water distribution systems by means of balancing cocks, valves, and fittings. Do not use service or shut-off valves for balancing unless indexed for balance point. Measure and record flows at each balancing device.

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6. Measure and record inlet and outlet temperatures at heat transfer elements and at cooling and heating plants at full cooling and heating capacity.

7. Where available pump capacity is less than total flow requirements or individual system parts, full flow in one part may be simulated by temporary restriction of flow to other parts.

I. Schedules:

1. Equipment requiring Testing, Adjusting, and Balancing including but not limited to:
   a. Fin-tube Radiation
   b. Cabinet Unit Heaters
   c. Air Cooled Refrigerant Condensers
   d. Condensing units
   e. Packaged Terminal Air Conditioning Units
   f. Fans
   g. Air Inlets and Outlets

J. Report Forms:

1. Forms shall include the following:
   a. Title Page:
      1) Name of Testing, Adjusting, and Balancing Agency
      2) Address of Testing, Adjusting, and Balancing Agency
      3) Telephone number of Testing, Adjusting, and Balancing Agency
      4) Project name
      5) Project location
      6) Project Architect
      7) Project Engineer
      8) Project Contractor
      9) Project altitude
      10) Report date
   b. All equipment shall include:
      1) Manufacturer
      2) Model/Size
      3) Identification/Number
      4) Serial Number
   c. Summary Comments:
      1) Design versus final performance
      2) Notable characteristics of system
      3) Description of systems operation sequence
      4) Summary of outdoor and exhaust flows to indicated amount of building pressurization
      5) Nomenclature used throughout report
      6) Test conditions
   d. Instrument List:
      1) Instrument
      2) Manufacturer
      3) Model number
      4) Serial number
      5) Range
      6) Calibration date
   e. Electric Motors: (data for single and multispeed motors)
      1) Manufacturer

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2) Model/Frame
3) HP/BHP/efficiency
4) Phase, voltage, amperage; nameplate, actual, no load
5) RPM
6) Service factor
7) Starter size, rating, heater elements
8) Sheave Make/Size/Bore

f. Air Cooled Condensing Unit:
1) Location
2) Serial number
3) Entering DB air temperature, design and actual
4) Leaving DB air temperature, design and actual
5) Number of compressors

g. Exhaust Fan Data:
1) Location
2) Air flow, specified and actual
3) External static pressure, specified and actual
4) Inlet pressure
5) Discharge pressure
6) Fan RPM

h. Duct Traverse:
1) System zone/branch
2) Duct size
3) Area
4) Design velocity
5) Design air flow
6) Test velocity
7) Test air flow
8) Duct static pressure
9) Air temperature
10) Air correction factor

i. Duct Leak Test:
1) Description of ductwork under test
2) Duct design operating pressure
3) Duct design test static pressure
4) Duct capacity, air flow
5) Maximum allowable leakage duct capacity times leak factor
6) Test apparatus
a) Blower
b) Orifice, tube size
c) Orifice size
d) Calibrated
7) Test static pressure
8) Test orifice differential pressure
9) Leakage

j. Air Monitoring Station Data:
1) Identification/location
2) System
3) Size
4) Area
5) Design velocity
6) Design air flow
7) Test velocity
8) Test air flow

k. Water Distribution Test Sheet:

1) Heat transfer terminal number.
2) Room number/location.
3) Terminal type.
4) Terminal size.
5) Design flow.
6) Test (final) flow.
7) Percent of design flow.

3.12 WELDING

A. Weld only by approved acetylene or electric welding processed and welders shall hold certificate from approved insurance company.

B. Conduct test to demonstrate suitability of procedures to be used in making welds which conform to specified requirements.

C. Specification for welding procedure shall meet requirements of Welding Qualifications, Section IX, ASME Boiler and Pressure Vessel Code and ANSI B31.1.

D. Align components. No strain shall be placed on weld during welding. No part of pipe shall be offset more than 20% of thickness. Set flanges and branches properly.

E. Welder Qualification:

1. Test welders to demonstrate ability to make acceptable welds. Tests conducted for qualification of welder for work under one division or section shall not qualify welder for work under another division or section.

2. Tests shall be as prescribed for welder qualification in Section IX of the ASME Code.

3. Records of such tests shall be as follows: Each welder shall be assigned an identifying number, letter or symbol. Identifying mark shall be stamped adjacent to welds made by this welder. Identification shall be at top of horizontal piping and at front of vertical piping.

4. Maintain record of welders employed, showing dates and results of tests and identifying mark assigned to each welder. Certify records and make them accessible to Owner's project representative and/or project manger. Before completion of project, one (1) copy of records shall be turned over to the Owner.

5. No qualification shall be older than three (3) years when welder commences work on this project. If welder has not welded in required welding process for a period of 6 months, he shall be recertified.

F. Welding Tests:

1. As designated by Architect, remove welds for destructive testing or for testing by non-destructive means. Tests shall be as determined by Architect.

2. If, in Architect's opinion, welds so tested do not meet requirements of Sections VIII and IX of ASME, remove welds welded by that welder, at no cost to the Owner. Re-welding shall be performed by qualified welder other than welder whose welds did not pass test. Welders whose welds were defective shall not be employed on-site for remainder of project.

3. Welding of stanchions, brackets, anchors and other welding not performed on pipe joints shall be in accordance with requirements of AWS Specifications and requirements.

END OF SECTION 23 00 00

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SECTION 26 00 00 – ELECTRICAL

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS AND REFERENCES

A. Include “General Requirements” and applicable parts of Division 1 as part of this section.

B. Examine all other sections of the Specifications for requirements which affect work under this Section whether or not such work is specifically mentioned in this section. Where paragraphs of this section conflict with similar paragraphs of Division 1, requirements of this section shall prevail.

C. Coordinate work with that of all other trades affecting, or affected by work of this section. Cooperate with such trades to assure the steady progress of all work under the Contract.

D. The Subcontractor shall be responsible for filing all documents, payment of all fees, and securing of all inspections and approvals necessary for the work of this section.

E. The Electrical Subcontractor shall carry in the Bid Price all Utility Company and Municipal back charges for all materials furnished and work performed by them in conjunction with this Contract and pay same to the respective agency upon demand. The Electrical Subcontractor shall not be entitled to additional compensation after the submittal of his bid price should he fail, for any reason, to obtain the total back charge costs to be incurred by the Local Utility Companies or Municipal Agencies.

1.2 DEFINITIONS

A. As used in this section, “provide” means “furnish and install”, and “POS” means “Provided Under Other Sections”.

B. As used in the Drawings and Specifications for Electrical work, certain non-technical words shall be understood to have specific meanings as follows, regardless of indications to the contrary in the General Conditions of other documents governing the Electrical work.

1. “Furnish” means: Purchase and deliver to the project site complete with every necessary appurtenance and support, all as part of the Electrical work. Purchasing shall include payment of all sales taxes and other surcharges as may be required to assure that purchased item(s) are free of all liens, claims, or encumbrances.

2. “Install” means: Unload at the delivery point at the site and perform every operation necessary to establish secure mounting and correct operation at the proper location in the project, all as part of the Electrical work.

3. “Provide” means: “Furnish” and “Install”.

4. “New” means: Manufactured within the past two (2) years and never before used.

C. Except where modified by a specific notation to the contrary, it shall be understood that the indication and/or description of any electrical item in the Drawings or Specifications for Electrical work carries with it the instruction to furnish, install and connect the item as part of the Electrical work, regardless of whether or not this instruction is explicitly stated.

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D. It shall be understood that the Specifications and Drawings for Electrical work are complimentary and are to be taken together for a complete interpretation of the Electrical work except that indications on the Drawings, which refer to an individual element of work, take precedence over the Specifications where they conflict.

1.3 SCOPE

A. Perform work and provide material and equipment as shown on Drawings and as specified or indicated in this Section of the Specifications. Completely coordinate work of this Section with work of other trades and provide a complete and fully functional installation.

1. Interior secondary distribution systems including all distribution panelboards, motor controls, magnetic starters, overcurrent and switching devices, panelboards, raceways, cables, wiring, junction and pull boxes, wireways, and all other components required for complete electrical distribution system.

2. All lighting systems (indoor, normal, night, emergency and exit) including all fixtures, lamps, mounting accessories, switches, controls, outlets, wiring, raceways, and all other components and fittings required for a complete lighting system.

3. Fire alarm system extension complete with all devices and wiring.

4. Wiring devices (switches and receptacles) complete with associated wallplates.

5. Power wiring to HVAC, plumbing and fire protection equipment.

6. Testing of all electrical systems.

7. Access panels (furnish only).

8. Coordination between electrical and other trades.

9. All other systems hereinafter specified or indicated on the Contract Drawings, complete, leaving ready an electrical system in perfect operating condition.

10. All required staging and scaffolding of any height.

B. Drawings and Specifications form complimentary requirements; provide work specified and not shown, and work shown and not specified as though explicitly required by both. Although work is not specifically shown or specified, provide supplementary or miscellaneous items, appurtenances, devices and materials obviously necessary for a sound, secure and complete installation.

C. Before submitting bid, visit and carefully examine site to identify existing conditions and difficulties that will affect work of this Section. No extra payment will be allowed for additional work caused by unfamiliarity with site conditions that are visible or readily construed by an experienced observer. Site visit is particularly important because this is renovation work.

D. Before starting work in a particular area of the project, visit site and examine conditions under which work must be performed including preparatory work done under other Sections or Contracts or by Owner. Report conditions that might affect work adversely in writing through Contractor to Architect. Do not proceed with work until defects have been corrected and conditions are satisfactory. Commencement of work shall be construed as complete acceptance of existing and preparatory work.

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1.4 RELATED WORK UNDER OTHER SECTIONS

A. The following items are not included in this section and will be performed under the designated sections.

1. Temporary Facilities.
2. Concrete:
   a. Equipment foundations.
   b. Housekeeping pads.
   c. Rebar for items “a, b, c & d” above.
3. Masonry: All openings in masonry walls.
4. Waterproofing, Dampproofing and Caulking.
5. Roofing and Flashing.
6. Painting: All painting except as specified herein.
7. Finish Carpentry and Millwork.
8. Steel Doors and Frames.
9. Finish Hardware.
10. Fire Protection.
11. Plumbing.
12. HVAC.

1.5 REGULATORY REQUIREMENTS

A. Comply with all applicable Federal and State laws, and all Local Codes, By-laws and Ordinances.

B. Where provisions of the Contract Documents conflict with any codes, rules or regulations, the latter shall govern. Where the contract requirements are in excess of applicable codes, rules or regulations, the contract provisions shall govern unless the Architect rules otherwise.

C. Request inspections from Authorities having jurisdiction, obtain all permits and pay for all fees and inspection certificates as applicable and/or required. All permits and certificates shall be turned over to the Owners at the completion of the work. Copies of permits shall be given to the resident engineer prior to the start of work.

D. Unless otherwise specified or indicated, materials and workmanship and equipment performance shall conform with the latest edition of the following standards, codes, Specifications, requirements and regulations:

1. State Building Code.
2. State Electrical Code.
3. National Fire Protection Association (NFPA).
4. Local Town Regulations and By-Laws.
5. Underwriter’s Laboratories, Inc. (UL).
6. National Electrical Manufacturer’s Association (NEMA).
7. American National Standards Institute (ANSI).

E. All Electrical work shall meet or exceed any other state and local codes and/or Authorities having jurisdiction including all other standards indicated herein.

1.6 SUBMITTALS

A. This paragraph shall supplement Division 1.

B. Definitions:

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1. Shop Drawings: Information prepared by the Contractor to illustrate portions of the work in more detail than shown in the Contract Documents.

2. Coordination Drawings: Detailed, large-scale layout Shop Drawings showing HVAC, Electrical, Plumbing and Fire Protection work superimposed to identify conflicts and ensure inter-coordination of Mechanical, Electrical, Architectural, Structural and other work.

3. Manufacturer's Product Data: Information prepared by the manufacturer which depicts standard equipment.

C. Submittals, Procedures and Format:

1. Review submittal packages for compliance with Contract Documents and then submit to Architect for review. Submit transparency and two (2) blue or black-line reproductions of each Shop Drawing larger than 8-1/2" x 11". Submit eight (8) sets of each smaller shop drawing. After review, transparency original of each large Shop Drawing and six (6) sets of each small shop drawing will be returned with reviewer's marks. Electronically submitted shop drawings are acceptable.

2. Each Shop Drawing shall indicate in title block, and each Product Data package shall indicate on cover sheet, the following information:
   a. Title.
   b. Name and location of project.
   c. Names of Architect, Engineer, Contractor and Subcontractor(s).
   d. Names of Manufacturer, Supplier, Vendor, etc.
   e. Date of submittal.
   f. Whether original submittal or resubmitted.

3. Shop Drawings and/or Manufacturer's Product Data shall contain detailed dimensional Drawings, accurate and complete description of materials of construction, manufacturer's published performance characteristics and capacity ratings (performance data alone is not acceptable), electrical requirements and wiring diagrams. Drawings shall clearly indicate location (terminal block or wire number), voltage and function for all field terminations, and other information necessary to demonstrate compliance with all requirements of Contract Documents.

D. Acceptable Manufacturers:

1. The Architect's Mechanical/Electrical design for each project is based on the single manufacturer listed in the schedule or shown on the Drawings. In Division 16 of these Specifications certain "Alternate Manufacturers" are listed as being acceptable. These are acceptable only if, as a minimum, they:
   a. Meet all performance criteria listed in the schedules and outlined in the Specifications.
   b. Have identical operating characteristics to those called for in the Specifications.
   c. Fit within the available space it was designed for, including space for maintenance and component removal, with no modifications to either the space or the product. Clearances to walls, ceilings and other equipment will be at least equal to those shown on the Contract Documents. The fact that a manufacturer's name appears as acceptable shall not be taken to mean the Architect has determined that the manufacturer's products will fit within the available space. This determination is solely the responsibility of the Contractor.
   d. For equipment mounted in areas where structural matters are a consideration, the products must have a weight no greater than the product listed in the schedules or Specifications.

e. Products must adhere to all architectural considerations including, but not limited to, being the same size and of the same physical appearance as scheduled or specified products.

E. Substitutions: Substitution of products by manufacturers other than those listed shall only be done in accordance with subparagraph “F” “Substitutions and Deviations”.

F. Substitutions and Deviations:

1. Deviations from the Contract Documents and the substitution of materials or equipment relative to the “Acceptable Manufacturers” referred to above shall be requested individually in writing whether deviations result from field conditions, standard shop practice, or other cause. Submit letter with transmittal of Shop Drawings which flags the substitution or deviation to the attention of the Architect. The letter shall describe changes in the system shown and physical characteristics (connections to adjacent materials, electrical services, service access requirements, and other characteristics), and differences in operating characteristics or cycles.

2. Without letters flagging the substitution or deviation to the Architect, it is possible that the Architect may not notice such substitution or deviation or may not realize its ramifications. Therefore, if such letters are not submitted to the Architect, the Contractor shall hold the Architect and his consultants harmless for any and all adverse consequences resulting from the deviations being implemented. Adverse consequences shall include, but not be limited to, excessive noise, excessive maintenance, shortened longevity, spatial coordination problems, and inadequate performance versus scheduled design. This shall apply regardless of whether the Architect has reviewed or approved Shop Drawings containing the deviation, and will be strictly enforced.

3. Do not request substitute materials or equipment unless identical material or equipment has been operated successfully for at least three (3) consecutive years. Such materials and equipment shall be a regular cataloged item shown in the current catalog of the manufacturer. When deviation or substitution is permitted, coordinate fully with related changes to Architectural, Structural, Plumbing, Fire Protection, Mechanical, and other work. Ensure that related changes necessary for coordination of substituted items are made within the Contract Price. Assume full responsibility for safety, operation and performance of the altered system. Any extra costs incurred to the project based on the use of alternate manufacturers shall be borne by the Contractor who has requested the substitution.

4. Substitutions of equipment, systems, etc. requiring approval of local Authorities must comply with such regulations and be filed by the Contractor (should filing be necessary).

5. Consideration will not be given to claims that the substituted item meets the performance requirements with lesser construction. Performance, as delineated in schedules and in the Specifications, shall be interpreted as minimum performance.

6. Approval of proposed deviations or substitutions, if any, will be made at discretion of Architect.

7. If equipment is proposed for substitution that is not tested and rated according to industry-wide standards, the Architect shall have the right to have performance tests completed, at the Contractor’s expense, to confirm the manufacturer’s performance claims.

G. Submittal Notations: Submittals will be returned from the Architect marked as illustrated below:

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☐ NO EXCEPTION TAKEN	☐ ACCEPTED AS NOTED
☐ NOT ACCEPTED	☐ REVISE AND RESUBMIT

1. Checking is only for general conformance with the design concept of the project and general compliance with the information given in the Contract Documents. Any action shown is subject to the requirements of the Drawings and Specifications. Contractor is responsible for dimensions which shall be confirmed and correlated at the job site; fabrication process and techniques of construction; coordination of his work with that of all other trades; and the satisfactory performance of his work.

H. Schedule: Incorporate the Shop Drawing review period into the construction schedule so that work is not delayed. Contractor shall assume full responsibility for delays caused by not incorporating the following Shop Drawing review time requirements into his project schedule. Allow at least ten (10) working days, exclusive of transmittal time, for review each time Shop Drawing is submitted or resubmitted with the exception that fifteen (15) working days, exclusive of transmittal time, are required for the following:

1. Motor control wiring diagram submittals.
2. Short circuit and coordination studies.
3. Coordination Drawings, if required by this Specification.
4. If more than five (5) Shop Drawings of this trade are received in one (1) calendar week.

I. List of Proposed Equipment and Materials: Within four (4) weeks after Award of Contract and before ordering materials or equipment, submit a complete list of proposed materials and equipment and indicate manufacturer's names and addresses. No consideration will be given to partial lists submitted out of sequence.

J. Responsibility:

1. The intent of submittal review is to check for capacity, rating, and certain construction features. Contractor shall ensure that work meets requirements of the Contract Documents regarding information that pertains to fabrication processes or means, methods, techniques, sequences and procedures of construction; and for coordination of work of this and other Sections. Work shall comply with submittals marked "REVIEWED" to extent that they agree with the Contract Documents. Submittal review shall not diminish responsibility under this Contract for dimensional coordination, quantities, installation, wiring, supports and access for service, nor the shop drawing errors or deviations from requirements of the Contract Documents. The Architect's noting of some errors while overlooking others will not excuse the Contractor for proceeding in error. Contract Document requirements are not limited, waived, nor superseded in any way by review.

2. Inform Subcontractors, Manufacturers, Suppliers, etc. of scope and limited nature of review process and enforce compliance with the Contract Documents.

K. Material and equipment requiring Shop Drawing and/or Manufacturer's Data Submittals shall include but not be limited to:

1. Light fixtures.
2. Panelboards.
3. Overcurrent and switching devices.
4. Wiring devices and wall plates.

5. Fire alarm system with wiring diagram and schedule.
6. Wiring and cables.
7. Conduit.
8. Boxes and fittings.
9. Safety switches.
10. Lighting controls.

1.7 SURVEYS AND MEASUREMENTS

A. Base all required measurements, both horizontal and vertical, on reference points established by the General Contractor and be responsible for the correct laying out of the Electrical work. In the event of a discrepancy between actual measurements and those indicated, notify the General Contractor in writing. Do not proceed with the work required until written instructions have been issued by the General Contractor.

1.8 COORDINATION

A. HVAC, Plumbing, Fire Protection, and Electrical Drawings are diagrammatic. They indicate general arrangements of Mechanical and Electrical systems and other work. They do not show all offsets required for coordination nor do they show the exact routings and locations needed to coordinate with Structural and other trades and to meet Architectural requirements.

B. Work shall be performed in cooperation with other trades on the project and so scheduled as to allow speedy and efficient completion of the work.

C. Furnish to other trades advance information on locations and sizes of all frames, boxes, sleeves and openings needed for their work. Furnish information and Shop Drawings necessary to allow trades affected by the work to install their work properly and without delay.

D. In all spaces, prior to installation of visible material and equipment, including access panels, review Architectural Drawings for exact locations and where not definitely indicated, request information from Architect. Where the Electrical work shall interfere with the work of other trades, assist in coordinating the space conditions to make satisfactory adjustments before installation. Without extra cost to the Owners, make reasonable modifications to the work as required by normal Structural interferences. Pay the General Contractor for additional openings, or relocating and/or enlarging existing openings through concrete floors, walls, beams and roof required for any work which was not properly coordinated. Maintain maximum headroom at all locations. All piping, duct, conduit, and associated components to be as tight to underside of structure as possible.

E. If any Electrical work has been installed before coordination with other trades so as to cause interference with the work of such trades, all necessary adjustments and corrections shall be made by the trades involved without extra cost to the Owners.

F. Where conflicts or potential conflicts exist and engineering guidance is desired, submit sketch of proposed resolution to Architect for review and approval.

G. Protect all materials and work of other trades from damage which may be caused by the Electrical work, and repair all damages without extra cost to the Owners.

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1.9 MECHANICAL AND ELECTRICAL COORDINATION

A. The HVAC Subcontractor shall furnish and install various electrical items relating to the heating and ventilating equipment and control apparatus. The Electrical Subcontractor shall be required to connect power wiring to this equipment unless noted otherwise.

B. The HVAC and Electrical Subcontractors shall coordinate their respective portions of the work, as well as the electrical characteristics of the heating, ventilating and air conditioning equipment.

C. All power wiring and local disconnect switches will be provided by the Electrical Subcontractor for the line voltage power. All control and interlocking wiring shall be the responsibility of the HVAC Subcontractor.

D. 120V and above power wiring sources extended and connected to HVAC control panels, transformers and switches shall be the responsibility of the Electrical Subcontractor. All low voltage thermostat, and any switch wiring shall be the responsibility of the HVAC Subcontractor.

E. Temperature control and equipment wiring shall be installed by the Heating and Ventilating Subcontractor.

F. Pipe heat tracing shall be furnished and installed by the Plumbing Subcontractor. Power connections shall be by the Electrical Subcontractor.

G. The Electrical Subcontractor will provide all magnetic starters except those furnished as an integral part of packaged equipment.

1.10 INSTALLATION REQUIREMENTS

A. The arrangement of all Electrical work shown on the Drawings is diagrammatic only and indicates the minimum requirements of the work. Conditions at the building including actual measurements shall determine the details of the installation. All work shall be laid out and installed so as to require the least amount of cutting and patching.

B. Review the Architectural Drawings and Specifications before ordering any material and equipment. Any discrepancies shall be brought to the attention of the Architect for his determination prior to proceeding with the work.

1.11 TYPICAL DETAILS

A. Typical details where shown on the Drawings shall apply to each and every item of the project where such items are applicable. They are not repeated in full on the Drawings, which in many cases are diagrammatic only, but with the intention that such details shall be incorporated in full. Any alternate method proposed for use by the Contractor shall have the prior approval of the Architect.

1.12 SLEEVES, INSERTS

A. Furnish and install all sleeves, inserts, anchor bolts and similar items to be set into masonry or concrete, as required for Mechanical and Electrical work. Internal diameter of sleeve ball shall be 1/2" larger than the outside diameter of the pipe or insulation covered line passing through it.

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1.13 CORING, DRILLING

A. Core, cut and/or drill all small holes 4.5” diameter or less in walls, floors and ceiling required for the installation of sleeves, supports, and conduit for the Electrical work.

1.14 FIRESTOPPING, SMOKEPROOFING AND WATERPROOFING

A. All penetrations made through fire rated assemblies (structures or partitions) shall be completely and properly fire sealed with the appropriate firestop systems installed in accordance with the Manufacturer’s recommendations. The firestop material UL listed fire rating shall match or exceed the fire rated assemblies. Verify with Architect if project is utilizing a specified product. If not, provide product manufactured by Hilti, Nelson or STI.

B. Provide waterproofing of all materials which penetrate a floor, exterior wall, slab or roof. All sleeves shall extend a minimum of 3 inches above floor or roof. All penetrations thru building foundation walls shall utilize Link-Seal products or approved equal.

1.15 COMMISSIONING OF SYSTEMS

A. Provide the services of a factory authorized technician to instruct and direct the Owner in the operation and maintenance of indicated systems and/or equipment. The Electrical Subcontractor shall be available throughout the entire Commissioning Phase to operate the systems/equipment. Systems and/or equipment that shall be commissioned include the following:

1. Panelboards.
2. Circuit breaker.
3. Disconnect switches.
4. Toggle switches.
5. Occupancy/Vacancy sensors.
6. Fire Alarm systems.
7. Motor controls.

B. Upon completion of all tests, the Electrical Subcontractor shall repair and/or replace any defective equipment. Once replaced and/or repaired, all Commissioning shall be performed.

C. Refer to Section 26 00 00 paragraph 3.2 for additional requirements.

1.16 ACCESSIBILITY

A. Install all work such that parts requiring periodic inspection, operation, maintenance and repair are readily accessible.

B. Furnish all access panels appropriate to particular conditions, to be installed by trades having responsibility for the construction of actual walls, floors or ceilings at required locations.

1.17 SUPPLEMENTARY SUPPORTING STEEL

A. Provide all supplementary (non-structural) steelwork required for mounting or supporting equipment and materials.

B. Steelwork shall be firmly connected to building construction as required. Locations and methods of attachment shall be approved by the Architect.

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C. Steelwork shall be of sufficient strength to allow only minimum deflection in conformity with manufacturer's published requirements.

D. All supplementary steelwork shall be installed in a neat and workmanlike manner parallel to floor, wall and ceiling construction: all turns shall be made at forty-five and ninety degrees, and/or as dictated by construction and installation conditions.

E. All manufactured steel parts and fittings shall be galvanized.

1.18 TOOLS AND EQUIPMENT

A. Provide all tools and equipment required for the fabrication and installation of the Mechanical and Electrical equipment at the site.

1.19 PORTABLE AND DETACHABLE PARTS

A. Contractors shall retain in their possession all portable and/or detachable parts and portions of materials, devices, equipment, etc. necessary for the proper operation and maintenance of the Mechanical and Electrical systems until final completion of the work, at which time they shall be handed over to the Owners.

1.20 RECORD DRAWINGS, PROJECT CLOSEOUT

A. As work progresses and for the duration of Contract, maintain a complete and separate set of prints of Contract Drawings at job site at all times. Record work completed and all changes from original Contract Drawings clearly and accurately including work installed as a modification or addition to the original design. Work shall be updated on a weekly basis and shall be made available for review by Architect. Failure to perform this work shall be reason for withholding requisition payments. In addition, take photographs of all concealed equipment in gypsum board ceilings, shafts, and other concealed, inaccessible work. At completion of work, make copies of photographs with written explanation on back. These shall become part of Record Documents.

B. At completion of work prepare a complete set of Record Drawings utilizing AutoCAD produced drawings showing all systems as actually installed, including all fire alarm and electrical circuitry. Submit three (3) sets of prints to Architect for comments as to compliance with this section.

C. The Architect will not certify the accuracy of the Record Drawings. This is the sole responsibility of the Electrical Contractor.

D. This trade shall submit the Record Drawings for approval by the Fire and Building Departments in a form acceptable to the departments, when required by the jurisdiction.

E. Record Drawings shall show record condition of details, sections, riser diagrams, control changes and corrections to schedules. Schedules shall show actual manufacturer, make and model numbers of final equipment installation.

1.21 GUARANTEE/WARRANTY

A. Guarantee and 24 Hour Service:

1. Guarantee Work of this Section in writing for not less than one (1) year following the date of acceptance by the Owner. If the equipment is used for temporary power etc, prior to acceptance by the Owner, the bid price shall include an extended period of warranty covering

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the one (1) year of occupancy, starting from the date of acceptance by the Owner. The guarantee shall repair or replace defective materials, equipment, workmanship and installation that develop within this period, promptly and to the Architect's satisfaction and correct damage caused in making necessary repairs and replacements under guarantee within Contract Price.

2. In addition to guarantee requirements of Division 1 and of Subparagraph A above, obtain written equipment and material warranties offered in manufacturer's published data without exclusion or limitation, in Owner's name.

3. Upon receipt of notice from the Owner of failure of any part of the systems or equipment during the warranty period, the affected part or parts shall be replaced by this Contractor without any reimbursement.

4. Replace material and equipment that require excessive service during guarantee period as defined and as directed by Architect.

5. Provide 24 hour service beginning on the date the project is accepted by the Owner, whether or not fully occupied, and lasting until the termination of the guarantee period. Service shall be at no cost to the Owner. Service can be provided by this Contractor or a separate service organization. Choice of service organization shall be subject to Architect and Owner approval. Submit name and a phone number that will be answered on a 24 hour basis each day of the week, for the duration of the service.

6. Submit copies of equipment and material warranties to Architect before final payment.

7. At end of guarantee period, transfer manufacturer's equipment and material warranties still in force to Owner.

8. This paragraph shall not be interpreted to limit Owner's rights under applicable codes and laws and under this Contract.

9. PART 2 paragraphs of this Specification may specify warranty requirements that exceed those of this paragraph. Those paragraphs shall govern.

10. Use of systems provided under this Section for temporary services and facilities shall not constitute Final Acceptance of Work by Owner, and shall not initiate the guarantee period.

11. Provide manufacturer's engineering and technical staff at site to analyze and rectify problems that develop during guarantee period immediately. If problems cannot be rectified immediately to Owner's satisfaction, advise the Architect in writing, describe efforts to rectify situation, and provide analysis of cause of problem. The Architect and/or Engineer will direct course of action.

1.22 OPERATING, INSTRUCTION AND MAINTENANCE MANUALS

A. Refer to Section 01700 – CONTRACT CLOSEOUT for submittal procedures pertaining to operating and maintenance manuals.

B. Each copy of the approved operating and maintenance manual shall contain copies of approved Shop Drawings, equipment literature, cuts, bulletins, details, equipment and engineering data sheets and typewritten instructions relative to the care and maintenance for the operation of the equipment, all properly indexed. Each manual shall have the following minimum contents:

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1. Table of Contents.

2. Introduction:
   a. Explanation of manual and its purpose and use.
   b. Description of the electrical systems.
   c. Safety precautions necessary for equipment.
   d. Illustrations, schematics and diagrams.
   e. Installation drawing.

3. Maintenance:
   a. Maintenance and lubricating instructions.
   b. Replacement charts.
   c. Trouble-shooting charts for equipment components.
   d. Testing instructions for each typical component.
   e. Two (2) typed sets of instructions for ordering spare parts. Each set shall include name, price, telephone number and address of where they may be obtained.

4. Manufacturer's Literature:
   a. The equipment for which Shop Drawings have been submitted and approved.

1.23 SERVICE CHARACTERISTICS

A. Secondary Building Voltage: 120/208.

B. All equipment and wiring shall be suitable for the applied voltage.

1.24 QUALITY ASSURANCE

A. The requirements of the State Building Code and Local regulations establish the minimum acceptable quality of workmanship and materials, and all work shall conform thereto unless more stringent requirements are indicated or specified herein.

B. All work shall comply with the latest editions of the codes as referenced herein.

C. Follow manufacturer's directions for articles furnished, in addition to directions shown on Drawings or specified herein.

D. Protect all work, materials, and equipment from damage during process of work. Replace all damaged or defective work, materials and equipment without additional cost to the Owner.

E. All equipment and materials for permanent installation shall be the products of recognized manufacturers and shall be new.

F. Equipment and materials shall:

   1. Where normally subject to Underwriters Laboratory Inc. listing or labeling services, be so listed and labeled.

   2. Be without blemish or defect.

   3. Not be used for temporary light and power purposes.

   4. Be in accordance with the latest applicable NEMA standards.

5. Buy products which will meet with the acceptance of all Authorities having jurisdiction over the work. Where such acceptance is contingent upon having the products examined, tested and certified by Underwriters or other recognized testing laboratory, the product shall be so examined, tested and certified.

G. Except for conduit, conduit fittings, outlet boxes, wire and cable, all items of equipment or material of one generic type shall be the product of one manufacturer throughout.

H. For items which are to be installed but not purchased as part of the Electrical work, the Electrical work shall include:

1. The coordination of their delivery.

2. Their unloading from delivery trucks driven into any point on the property line at grade level.

3. Their safe handling and field storage until the time of permanent placement in the project.

4. The correction of any damage, defacement or corrosion to which they may have been subjected. Replacement, if necessary, shall be coordinated with the Contractor who originally purchased the item.

5. Field erection and internal wiring as necessary for their proper operation.

6. Mounting in place, including the purchase and installation of all dunnage, supporting members, and fastenings, necessary to adapt them to architectural and structural conditions.

I. Items which are to be installed but not purchased as part of the electric work shall be carefully examined upon delivery to the project. Claims that any of these items have been received in such condition that their installation will require procedures beyond the reasonable scope of the electric work will be considered only if presented in writing within one (1) week of the date of delivery to the project of the items in question. The electric work includes all procedures, regardless of how extensive, necessary to put into satisfactory operation, all items for which no claims have been submitted as outlined above.

1.25 DELIVERY, STORAGE AND HANDLING

A. All materials for the work of this section shall be delivered, stored and handled so as to preclude damage of any nature. Manufactured materials shall be delivered and stored in their original containers, plainly marked with the products' and manufacturer's name. Materials in broken containers or in packages showing watermarks or other evidence of damage, shall not be used and shall be removed from the site.

1.26 TEMPORARY POWER AND LIGHTING

A. The Electrical Subcontractor shall furnish and install feeders of sufficient size from the Utility Company's power lines for the electric light and power requirements for the building while under construction and until the permanent feeders and related equipment have been installed and are in operation. Temporary lighting shall be based on a minimum of one watt per square foot covering each and every square foot of floor area in the building. Sufficient wiring, lamps, and outlets shall be installed to insure proper lighting in all rooms, space, stairwells, and corridors. Minimum sized lamp used shall be 100 watt. Where higher lighting intensities are required by Federal or State Standards of Laws or otherwise specified, the above specified wattage shall be increased to provide these increased intensities.

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B. All necessary transformers, meters, cables, panelboards, switches, temporary lamp replacements and accessories required for the temporary light and power installation shall be provided by the Electrical Subcontractor.

C. The Electrical Subcontractor shall provide and maintain on each floor of the building, a feeder or feeders of sufficient capacity for the requirements of the entire floor and he shall provide a sufficient number of outlets, located at convenient points so that extension cords of not over 50 feet in length will reach all work requiring temporary light or power.

D. The Electrical Subcontractor shall install and maintain the wiring and accessories for the offices of the General Contractor and the Clerk of the Works as specified in the contract form.

E. All temporary Electrical work shall meet the requirements of the National Electrical Code Article 590 Temporary Wiring, the Local Utility Company, and all Federal Standards and Laws.

F. All temporary wiring and accessories thereto installed by the Electrical Subcontractor shall be removed after their purposes have been served.

G. The General Contractor will pay for the cost of electric energy consumed by himself and by all of his Subcontractors, unless otherwise indicated.

H. All lamps installed in permanent lighting fixtures and used for lighting during construction shall be replaced by the Electrical Subcontractor just prior to date of Use and Occupancy or Final Acceptance.

I. Provide all temporary lighting and power required above during the normal working hours of the project or a total of ten (10) hours per normal working day; Saturdays, Sundays and legal holidays are excluded. The ten hours per day shall include manning the temporary power and lighting 1/2 hour before and 1/2 hour after a normal eight (8) hour working day. In addition to the above, provide and maintain, to the satisfaction of the local Authorities having jurisdiction, all temporary lighting and power that may be required for safety purposes. The Electrical Subcontractor will be compensated by the General Contractor for any additional standby time, materials or equipment required by the General Contractor or other Subcontractors beyond the normal working hours, as defined above.

1.27 STAGING AND SCAFFOLDING

A. Provide staging and scaffolding for all the work of this section complying with Division 1 requirements.

1.28 EXTRA MATERIALS

A. Furnish extra materials as indicated below that match products installed, are packaged with protective covering for storage, and are identified with labels clearly describing contents.

1. 10% of each total lamps installed.
2. 10% of each total circuit breakers installed.
3. 10% of each total fuses installed.
4. Ten (10) toggle switches and duplex receptacles.
5. 10% of total audio/visual appliances installed.
6. 10% of each total pull stations and smoke detectors installed.

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1.29 SEISMIC REQUIREMENTS

A. Equipment and work shall meet the restraint requirements for the designated Seismic Design category. This shall include all installation and connections of material and equipment to the building structure. Refer to Structural Drawings for Seismic Design category and ASCE7 for electrical requirements.

1.30 PHASING, DEMOLITION AND MAINTAINING EXISTING SERVICES

A. During the execution of the work, required relocation, etc., of existing equipment and systems in the existing building areas where new work is to be installed or new connections are scheduled to be made, shall be performed by the Electrical Subcontractor, as required by job conditions and as determined by the Architect in the field, to facilitate the installation of the new system, while demolition, relocation work or new tie ins will be performed. Outages required for construction purposes shall be scheduled for the shortest practical period of time, in coordination with the Owner's designated representative, for specified, mutually agreeable periods of time, after each of which the interruption shall cease and the service shall be restored. This procedure shall be repeated to suit the Owner's working schedule, as many times as required until all work is completed. Any outages of service shall be approved by the Owner, prior to commencing the work. No outages or shutdowns of service shall occur without the written authorization of the Owner prior to commencing the work. Give notice of any scheduled shutdowns, a minimum of two (2) weeks in advance. Owner shall make their best efforts to meet this request without adversely affecting the electric service to the existing building.

B. Prior to any deactivation and relocation or demolition work, consult the Drawings and arrange a conference with the Architect and Owner's representative in the field to inspect each of the items to be deactivated, removed or relocated. Care shall be taken to protect all equipment designated to be relocated and reused or to remain in operation and be integrated with the new systems.

C. All deactivation, relocation and temporary tie-ins of electrical systems and equipment shall be provided by the Electrical Subcontractor. All demolition and removal of electrical systems and equipment designed to be demolished shall be provided by the Electrical Subcontractor. Place all demolished electrical materials except hazardous materials (PCB lighting ballasts, fluorescent lamps, etc.) as determined by the Authority Having Jurisdiction in General Contractor's dumpster. All hazardous electrical materials shall be legally disposed of by the Electrical Subcontractor.

D. The Owner reserves the right to inspect the material scheduled for removal and salvage any items he deems usable as spare parts.

E. Phasing:

1. The Electrical Subcontractor shall construct the subject project in phases as directed by the Architect to suit the project progress schedule, as well as the completion date of the project.

2. For additional information related to phasing, review the General Conditions and Supplementary Conditions and the Architectural Drawings.

PART 2 – PRODUCTS

2.1 GENERAL

A. Product Specifications are written in such a manner so as to specify what materials may be used in a particular location or application and therefore do not indicate what is not acceptable or

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suitable for a particular location or application. As an example: Non-metallic sheathed cable is not specified; therefore it is not acceptable.

B. For purpose of establishing a standard of quality and not for purposes of limiting completion, the basis of this Specification is upon specified models and types of equipment and materials, as manufactured by specified manufacturers.

C. In all cases, standard cataloged materials and systems have been selected. Materials such as lighting fixtures specially manufactured for this particular project, and not part of a manufacturer's standard product line, will not be acceptable. In the case of systems, the system components shall be from a single source regularly engaged in supplying such systems. A proposed system made up of a collection of various manufacturers products will be unacceptable.

D. Where Specifications list manufacturers names and/or "as approved" or "equal approved by Designer", other manufacturers equipment will be considered if equipment meets Specification requirements and has all features of the specified items as are considered essential by the Architect.

E. All materials shall be new and shall be UL listed.

2.2 ARC-FLASH HAZARD WARNING

A. In accordance with NFPA 110.16, all electrical equipment shall be provided with factory or field marking which will warn personnel of potential electric arc flash hazards.

2.3 RACEWAYS AND FITTINGS

A. Raceways – General:

1. No raceway shall be used smaller than 3/4" diameter. No conduit shall have more than three (3) 90° bends in any one run, and where necessary, pull boxes shall be provided.

2. Rigid metal conduit (RMC) conforming to, and installed in accordance with, Article 344 of NFPA 70 shall be heavy wall zinc coated steel conforming to American Standard Specifications C80-1 and may be used for service work, exterior work, slab work, and below grade level slab, wet locations, and in mechanical rooms and where raceway may be subjected to mechanical damage, i.e., loading docks, workshops, etc.

3. Intermediate metal conduit (IMC) conforming to, and installed in accordance with Article 342 of NFPA 70 shall be zinc coated steel and may be used in all areas similar to RMC.

4. Thin wall conduit (EMT), conforming to, and installed in accordance with, Article 358 of NFPA 70 shall be zinc coated steel, conforming to industry standards, may be used in masonry block walls, stud partitions, above furred ceilings where exposed but not subject to mechanical damage, and shall be used for fire alarm work.

5. Flexible metal conduit (FMC) conforming to, and installed in accordance with Article 348 of NFPA 70 shall be used for connections to recessed light fixtures, vibrating equipment and motors. All FMC shall be secured and supported in accordance with Article 348 of NFPA 70.

6. Liquidtight flexible metal conduit (LFMC) conforming to, and installed in accordance with Article 350 of NFPA 70 shall be used for connections to light fixtures, vibrating equipment and motors. All LFMC shall be secured and supported in accordance with Article 350 of NFPA

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70. If used on roof applications, all LFMC shall be supported by sleepers approved by the Architect prior to installation.

7. Rigid non-metallic conduit may be used at the Contractor's option for underground electric and telephone services outside the foundation wall and shall be polyvinyl chloride (PVC) schedule 40 or 80, 90° C. If option of rigid non-metallic conduit is exercised, underground runs outside the foundation wall shall be concrete encased at Contractor's expense. Schedule 40/80 conduit shall be installed in conformance with Article 352 of NFPA 70. Use of type EB or A PVC conduit is not allowed.

8. PVC Schedule 40 may also be used for below grade slab circuits within building confines. Below slab rigid non-metallic conduits do not require concrete encasement. Rigid non-metallic conduits shall not be used in slabs. Rigid steel elbows or stubs shall be used for penetrations from below slab or through exterior walls into building. PVC shall not be installed within building. Raceways and fittings shall be produced by same manufacturer. All PVC conduit shall comply with ANSI/UL 651.

9. Acceptable Manufacturers:
   a. Wheatland Tube Company
   b. Allied Tube
   c. Western Tube & Conduit
   d. Carlon
   e. Perma-Cote Supreme
   f. Cantex

10. Fittings:
    a. Provide insulated bushings on all raceways that house conductors #4 AWG or larger at all threaded fittings no matter what the size of the conductor.
    b. Manufacturer's standard fittings shall be used for raceway supports.
    c. Expansion Fittings: Expansion fittings shall be used where structural and concrete expansion joints occur and shall include a ground strap.
    d. Couplings for rigid metal conduit and IMC shall be threaded type. Provide insulated bushings.
    e. All fittings for EMT conduit shall be steel. No die-cast fittings are allowed. Set screw and compression connectors are allowed.
    f. Threadless fittings for EMT shall be watertight compression type. Set-screw type fittings are not acceptable. All fittings shall be concrete tight. No die-cast fittings allowed.
    g. Cable supports in vertical raceways shall be of the split wedge type. Armored cable supports for vertical runs to be of wire mesh basket design.
    h. Wall entrance seals shall be equal to O.Z. Gedney type "WSK" or Link-Seal.
    i. Couplings, elbows and other fittings used with rigid nonmetallic raceways shall be of the solvent cemented type to secure a waterproof installation.
    j. Acceptable manufacturers:
       1) O.Z. Gedney
       2) Crouse Hinds
       3) American Fittings
       4) Hubbell
       5) Thomas & Betts

2.4 WIRING MATERIALS

A. Building Wire and Cable shall be copper with 600V insulation, THWN for branch circuitry and XHHW for feeders.

B. Conductors shall be of soft drawn 98% minimum conductivity properly refined copper, solid construction where No. 10 AWG and smaller, stranded construction where No. 8 AWG and larger.

C. Exterior of wires shall bear repetitive markings along their entire length indicating conductor size, insulation type and voltage rating.

D. Exterior of wires shall be color coded, so as to indicate a clear differentiation between each phase and between each phase and neutral. In all cases, grounded neutral wires and cables shall be identified by the colors “white” or “gray”. In sizes and insulation types where factory applied colors are not available, wires and cables shall be color coded by the application of colored plastic tapes in overlapping turns at all terminal points, and in all boxes in which splices are made. Colored tape shall be applied for a distance of 6 inches along the wires and cables, or along their entire extensions beyond raceway ends, whichever is less.

E. Final connections to motors shall be made with 18” of neoprene sheathed flexible conduit.

F. Minimum branch circuit conductor size shall be No. 12 AWG installed in conduit. Motor control circuit wiring shall be minimum No. 14 AWG installed in conduit.

G. Fire alarm and security system wiring shall be per manufacturer’s recommendations.

H. Other wires and cables required for the various systems described elsewhere in this section of the Specifications shall be as specified herein, as shown on the Contract Drawings, or as recommended by the manufacturer of the specific equipment for which they are used, all installed in conduit.

I. Metal clad sheathed cable NFPA 70, type MC may be used for branch circuitry where shown and where run concealed and not subject to physical damage. All type MC cable used shall contain a full size insulated ground conductor. All conductors shall be copper. All type MC cable insulation used shall have voltage rating of 600 volts, shall have a temperature rating of 75° C, and shall be thermoplastic material. Armor material shall be steel and armor design shall be interlocked metal tape. Fire alarm rated MC cable may be used for fire alarm work where concealed and acceptable to the Local Authority Having Jurisdiction.

J. Wiring materials shall be manufactured by Southwire, Prysmian, General Cable, or equal.

2.5 OUTLET, JUNCTION, PULL BOXES AND WIRING TROUGHS FOR ALL SYSTEMS

A. Outlets:

1. Each outlet in wiring or raceway systems shall be provided with an outlet box to suit conditions encountered. Boxes installed in normally wet locations shall be of cast-metal type having hubs. Concealed boxes shall be cadmium plated or zinc coated sheet metal type. Old work boxes with Madison clamps are not allowed in new construction.

2. Each box shall have sufficient volume to accommodate number of conductors in accordance with requirements of NFPA 70. Boxes shall not be less than 1-1/2” deep unless shallower boxes are required by structural conditions and are specifically approved by Architect. Ceiling and bracket outlet boxes shall not be less than 4” octagonal except that smaller boxes may be used where required by particular fixture to be installed. Flush or recessed fixtures shall be provided with separate junction boxes when required by fixture terminal temperature requirements. Switch and receptacle boxes shall be 4” square or of comparable volume.

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3. Acceptable Manufacturers:
   a. Appleton
   b. Crouse Hinds
   c. Steel City
   d. RACO

B. Pull and Junction Boxes: Where necessary to terminate, tap off, or redirect multiple raceway runs or to facilitate conductor installation, furnish and install appropriately designed boxes. Boxes shall be fabricated from code gauge steel assembled with corrosion resistant machine screws. Box size shall be as required by Code. Where intermediate cable supports are necessary because of box dimensions, provide insulated removable core brackets to support conductors. Junction boxes are to be equipped with barriers to separate circuits. Where splices are to be made, boxes shall be large enough to provide ample work space. All conductors in boxes are to be clearly tagged to indicate characteristics. Boxes shall be supported independently of raceways. Junction boxes in moist or wet areas shall be galvanized type. Boxes larger than 4 inches square shall have hinged covers. Boxes larger than 12 inches in one dimension will be allowed to have screw fastened covers, if a hinged cover would not be capable of being opened a full 90 degrees due to installation location.

2.6 WIRING DEVICES

A. Provide wiring device type plates for all wall-mounted devices. All wall plates shall be smooth high impact nylon for all areas, color as directed by the Architect. Provide galvanized steel for all Utility, Electric and Mechanical Rooms.

B. Wiring devices standard for the project (i.e., with no specific type indicated) shall conform to the following:

   1. Visible part colors of wiring devices shall be as directed by the Architect for all areas. Provide brown devices for all Utility, Electrical and Mechanical rooms.

   2. Exclude compact or “despard” type devices.

C. Wiring device switches shall be toggle type, A.C. quiet design, specification grade, 20 amps on 120 volt circuits. Switches shall be mounted 48” to center line above finished floor unless noted otherwise.

   1. Single pole switch shall be equal to Hubbell No. 1221.
   2. Double pole switch shall be equal to Hubbell No. 1222.
   3. Three-way switch shall be equal to Hubbell No. 1223.
   4. Four-way switch shall be equal to Hubbell No. 1224.
   5. Single pole pilot light switch shall be equal to Hubbell No. HBL 1221PL.
   6. Equivalent 277 volt 20 amp switches shall be used where required.

D. Standard duplex convenience receptacles shall be 125 volt, 20 amps, three wire (two circuit wires plus ground), “U-bar” ground NEMA slot configuration 5-20R, specification grade. Receptacles shall be mounted 18” to center line above finished floor unless noted otherwise.

   1. Equal to Hubbell No. 5362.

   2. Where indicated on plans provide receptacles with ground fault current interrupters, UL Class A; 20A, 125V to be equal to Hubbell No. GF5362. All GFI receptacles shall be self-testing type in compliance with UL 943.

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E. Non-standard convenience receptacles and special purpose power supply receptacles shall be as listed on plans.

F. Devices and device plates for flush wall devices which are not integrally equipped with same, shall be as directed by the Architect.

G. For unfinished spaces, plates for surface-mounted wall devices which are not integrally equipped with same, shall be galvanized sheet steel, formed raised type which does not overlap box. Where for switches, such plates shall have toggle guards.

H. Where more than one wiring device is indicated in the same location, the devices shall be mounted in gang under a common wall plate.

I. Mount duplex convenience and power receptacles vertically with grounding posts at top of device unless otherwise indicated. Locate grounding post to left when horizontal mounting is indicated.

J. Wiring devices and associated hardware shall be manufactured by Leviton, Hubbell or Pass and Seymour.

2.7 GROUNDING REQUIREMENTS

A. Ground all systems and equipment in accordance with best industry practice, the requirements of NFPA 70, Article 250 and the following:

1. Provide grounding bonds between all metallic conduits of the light and power system which enter and leave cable chambers or other non-metallic cable pulling and splicing boxes. Accomplish this by equipping the conduits with bushings of the grounding type individually cross connected.

2. Bond metallic conduits containing grounding electrode conductors and main bonding conductors to the ground bus service enclosure and/or grounding electrode at both ends of each run utilizing grounding bushings and jumpers.

3. Provide grounding bonds for all metallic conduits of the light and power system which terminate in pits below equipment for which a ground bus is specified. Accomplish this by equipping the conduits with bushings of the grounding type connected individually to the ground bus.

4. Provide supplementary ground bonding where metallic conduits terminate at metal clad equipment (or at the metal pull box of equipment) for which a ground bus is specified. Accomplish this be equipping the conduits with bushings of the grounding type connected individually by means of jumpers to the ground bus. Exclude the jumpers where directed. This exclusion will be required where an isolated ground for electronic equipment is to be maintained.

5. Each grounding type bushing shall have the maximum ground wire accommodation available in standard manufacture for the particular conduit size. Connection to bushing shall be with wire of this maximum size.

6. Bonding conductors on the load side of the service device and equipment grounding conductors shall be sized in relation to the fuses or trip size of the overcurrent device supplying the circuit.

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7. The central equipment for the fire protective alarm system and telephone system shall have its grounding terminal connected to the grounding electrode by means of a No. 6 green coded insulated conductor, run in 3/4" conduit. Utilize a ground clamp of a type specifically manufactured for the purpose.

2.8 PHASING AND COLOR CODING

A. The insulation or covering of each wire or cable shall be color coded so as to provide for circuit identification as specified below:

120/208 V Circuits	Phase Circuits
Black	A
Red	B
Blue	C
White	Neutral
Green	Equipment Ground

B. Color coding shall be achieved by one of the following methods:

1. The insulation or covering shall be coded during manufacture by use of one of the following methods:
   a. Colored compounds.
   b. Colored coatings.

2. In sizes and insulation types where factory applied colors are not available, wires and cables shall be color coded by the application of colored plastic tapes in overlapping turns at all terminal points, and in all boxes in which splices are made.

C. The same colored cable shall be connected to the same phase throughout the project.

D. In general, building load centers and panelboards shall be phased “A”, “B”, “C”, left to right. The neutral, although it may be in different locations for different equipment, shall be identified.

2.9 ENCLOSURES FOR INDIVIDUALLY MOUNTED OVERCURRENT AND SWITCHING DEVICES

A. Construction shall be NEMA Class I, where installed indoors.

B. Construction shall be NEMA Class IIIR, where installed outdoors, in mechanical rooms, in locations defined as damp or wet by NFPA 70 or where indicated as weatherproof.

C. Operating handles shall be front or side type to accommodate hand access space and flush or surface mounting requirements.

D. Each shall be equipped with padlock for locking operating handle in the open position.

2.10 PANELBOARDS

A. Panelboards shall consist of factory completed dead front assemblies of back pans, main busses, overcurrent and switching units, sheet metal cabinets and trims. They shall be so designed that switching and overcurrent devices can be replaced without disturbing adjacent units and without removing the main bus connectors, so that circuits may be changed without machine drilling or tapping.

B. Where indicated as power or distribution panels, they shall be as manufactured by Square D, Siemens, Eaton, or General Electric.

C. Bus bars for their mains shall be of copper having current capacities as indicated and sized for such capacities in accordance with Underwriter Laboratory standards. Provide double size neutral bus bars and lugs for all 120/208 volt panelboards where fed from “K” rated transformers. Bus bar taps for panels with single pole branches shall be arranged for sequence phasing of the branch circuit devices. Bussing shall be braced throughout to conform to industry standard practice governing short circuit stresses in panelboards. Phase bussing shall be full height without reduction.

D. A ground bus shall be provided for each panel. Each ground bus shall be of the same material as the phase and neutral buses.

E. Cabinets shall be fabricated from industry standard gauge galvanized sheet steel with corners lapped and riveted, or fastened by approved methods.

F. The inside and outside of the trims shall be factory painted with one (1) rust proofing primer coat and one (1) finish coat. The finish paint shall be of a type to which field applied paint will bond. All trims shall be hinged.

G. Cabinets and trims shall be suitable for the required mounting. Trims shall be fastened to cabinets and shall be of a type that is self-supporting on cabinets. Trims for flush panels shall overlap cabinets by at least 3/4" all around. Where two section panels are required, cabinets shall be of equal height including those cases where there is one main for both sections.

H. Cabinets and trims for lighting and appliance panels shall accommodate and conform to the following limited dimensions:

1. Minimum wiring gutter width on each side: 5-3/4”.
2. Maximum overall width: 24”.
3. Maximum overall depth: 6”.

I. Where wires or cables are used within panelboards to make up internal connections (factory installed or otherwise) such wire or cable shall have copper conductors only.

J. Any cabinet for a power or distribution panel shall (regardless of the actual devices required to be in it) have a width, depth and bussing adequate for a 3-pole branch device equal in rating to the panel mains. In no case shall the cabinet be wider than 42” or deeper than 18”.

K. Hinged doors covering all switching device handles shall be included in all panel trims.

L. Doors in panelboard trims shall conform to the following:

1. In making switching device handles accessible, doors shall not uncover any live parts.

2. Doors shall have flush type paracentric cylinder locks and catches. Two (2) keys shall be supplied for each lock and each key shall open all panelboards. Locks and keys shall conform to a “standard keying policy” as directed.

M. Where “spaces only” for overcurrent protection and switching devices are called for in a panel, its main bus, and backpan, as well as its cabinet and trim, shall be extended to accommodate these spaces and shall include all necessary hardware including bus connectors to add future devices.

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N. Panelboards shall comply with the following industry standards:

1. UL Standards:
   a. Panelboards – UL67.
   b. Cabinet & Boxes – UL50.

2. NEMA Standard – PB1.

O. Panelboards shall be labeled with UL short-circuit rating adequate for the available short-circuit and based on the lowest panel mounted circuit breaker available UL listed interrupting current rating, but in no case less than 65 ka for 480 volt and 22 ka for 240 volt panelboards.

P. Provide “lock on” clips for the toggle handles of certain branches serving the Fire Alarm System, security, etc.

Q. Panelboards shall be manufactured by Eaton, Siemens, Square D, or General Electric.

2.11 MOLDED CASE CIRCUIT BREAKERS

A. Molded case type circuit breakers shall consist of manually operated quick-make quick-break mechanically trip free operating mechanisms for simultaneous operation of all poles, with contacts, arc interrupters and trip elements for each pole, all enclosed in molded phenolic plastic cases.

1. Their tripping units shall be of the “thermal magnetic” type having bimetallic elements for time delay overload protection and magnetic elements for short-circuit protection.

2. They shall be manually operable by means of toggle type operating handles having “tripped” position midway between the “on-off” position.

3. They shall each be contained in an individual case enclosing only the number of poles required for the particular breaker.

4. All panels and individually mounted circuit breakers shall have short circuit ratings exceeding the available short-circuit of the values indicated in the “Power System Studies” in this section by a factor of 1.2 with a minimum as follows:
   a. 240V class panels/breakers: 10 kAIC where shown fed by a 150 kVA or less transformer
      1) 10 kAIC where shown
      2) 22 kAIC where shown fed by a 300 kVA or less transformer.
   b. 480V Class Panels/Breakers shall be 65 kAIC.

5. They shall be of the “bolted-in” type.
   a. Where necessary, to accommodate other requirements, their frame sizes shall be increased to conform to such requirements, frame sizes being indicated only as a reference to the minimum acceptable interrupting ratings noted above.
   b. Where single pole in trip sizes 20 amps or less, they shall be rated for switching duty.
   c. They shall be equipped with 5 milliamp sensitivity ground fault interrupting features where so indicated.
   d. All circuit breakers connected to lighting branch circuits shall be high magnetic type breakers.

6. They shall be manufactured by Square D, Siemens, Eaton, or General Electric.

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2.12 CARTRIDGE FUSES

A. Cartridge fuses shall be as follows:

1. Provide a complete set of fuses for each item of fusible type equipment. Fusible equipment furnished by other contractors will be complete with fuses.

2. Secondary system fuses, rated at 600 volts or less, shall be UL listed and constructed in conformance with the applicable standards set forth by NEMA and ANSI. All fuses of a particular class shall be of same manufacturer.

3. Regardless of actual fault current, they shall, at full recovery voltage, be capable of safely interrupting fault currents of 200,000 amperes RMS symmetrical or 340,000 amperes RMS asymmetrical, deliverable at the line side of the fuse.

4. Circuits 0-600 amperes shall be protected by the equal of Bussman “Low Peak” current limiting fuses, LPN-RK (250 volts), LPS-RK (600 volts), UL class RK-1.

5. Fuses shall be suitable for application to fuse gaps which reject other types of fusing.

6. Supply 10% spare fuses of each size and type 60 amps and less. Supply three (3) spare fuses for each size and type over 60 amps.

B. Cartridge fuses shall be manufactured by Bussman, Gould or EFCO.

2.13 MOTOR CONTROLS

A. Motor Controls – Manual and Magnetic:

1. Individually-mounted magnetic starters shall be across-the-line type with thermal overload on each phase, single-speed, two-speed, or reduced voltage start as indicated. Check exact type of two-speed or part-winding motors to be furnished by other contractors, and provide proper starter.

2. Starters shall be of the replaceable contact double break type, of size and type required for particular motor horsepower and voltage. Minimum size starter to be size 1.
   a. Starters shall have OL reset button, green pilot light to indicate “ON”, and “HAND-OFF-AUTO” switch in cover. Pilot lights shall be push-to-test type.
   b. Starters to have 120 volt control transformers with fused output being provided for those units operating on 277/480 volt system.
   c. Provide proper rating of thermal overloads. Replace any overloads found to be of an incorrect rating. Provide a spare set of three (3) thermal overloads for each starter.
   d. Provide four (4) sets of auxiliary contacts of convertible type N.O. to N.C. for each starter.
   e. Motor starters installed in dry locations shall have NEMA I enclosures. Those in wet locations shall have NEMA IV enclosures.
   f. Acceptable Manufacturers:
      1) Siemens
      2) Eaton
      3) Square D
      4) General Electric

3. Manual motor starters shall have pilot lights and shall be furnished with thermal overloads on each phase.

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B. Motors: Each motor shall have disconnect switch and starter provided under this section. Starters which are a part of “factory assembled” control panel will be provided under section supplying equipment to be controlled but connected under this section.

C. Disconnect Switches:

1. Disconnect (safety) switches shall conform to industrial standards of NEMA, be UL listed and shall be heavy-duty type, quick-make, quick-break type with interlocking cover mechanism and provisions for padlocking switch handle in “OFF” position. Three (3) pole toggle switches are not acceptable as substitute for disconnect switches.

2. Disconnect switches shall be of fused or un-fused type as indicated with number of disconnecting poles indicated. The grounded conductor shall not be switched. Switches shall be for use with current limiting fuses with rejection type fuse clips and those shall be horsepower rated.

3. Enclosures shall be of proper NEMA type for the intended location and shall be phosphate coated or equivalent code gauge galvanized sheet steel with gray baked enamel finish.

4. Acceptable Manufacturers:
   a. Eaton
   b. Siemens
   c. Square D
   d. General Electric

D. Combination Starter: Provide combination starters where indicated on the plans.

E. Motor Control Circuitry:

1. Except as noted below, select materials exactly as specified for feeders. Utilize No. 12 A.W.G. THWN conductors throughout minimum.

2. Motor control circuit wires may be run in the same conduit as the wires of motor power circuits; however, exclude motor control wires from enclosures (other than motor starter enclosures) which contain power circuit overcurrent protection and switching devices; also from pull boxes and junction boxes containing the wires of main and sub main feeders. Utilize auxiliary pull boxes to separate motor control wires from motor power circuit wires before the power circuit wires enter the items from which motor control wires are excluded.

3. Prior to installing any motor control circuitry for a particular motor, notify the Architect of any deviations between the control circuitry requirements of the trade supplying the motor and the indicated electric work.

2.14 LOW VOLTAGE LIGHTING CONTROL DEVICES

A. Scope: The Electrical Subcontractor, as part of the work of this section, shall furnish and install low voltage lighting control devices as indicated on the project documents and described herein.

B. Low voltage lighting control devices shall include but are not limited to the following devices:

1. Dual technology (infrared and ultrasonic) occupancy/vacancy sensors, both ceiling mounted and/or wall mounted.

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2. Dual technology (infrared and ultrasonic) occupancy/vacancy wall switches, both single button and dual button types.

3. Digital room controllers, self-configuring, digitally addressable one, two or three relay plenum rated controllers for ON/OFF or dimming controls.

4. Digital dimming wall switch compatible with digital room controllers.

5. Emergency lighting control unit (ELCU) shall allow a standard lighting control device to control emergency lighting in conjunction with Normal Lighting in any areas with a building.

C. Submittals:

1. Submit shop drawings and relevant product information as listed below:
   a. Composite wiring and/or schematic diagram of each control circuit as proposed to be installed.
   b. Catalog sheets, specifications and installation instructions for each device.

D. Quality Assurance: The low voltage lighting control device manufacturer shall have a minimum of ten (10) years of experience in the manufacture of lighting control devices.

E. Warranty: Provide a five (5) year manufacturer's warranty on all low voltage lighting control devices.

F. Manufacturers:

1. This specification is based on products as manufactured by WattStopper.

2. Acceptable Manufacturers: Subject to the compliance with the requirements of the contract documents, acceptable manufacturers are listed below:
   a. WattStopper
   b. Sensor Switch
   c. Cooper Wiring Devices

G. Equipment:

1. Dual technology (infrared and ultrasonic) occupancy/vacancy sensor.
   a. Wall or ceiling mounted as indicated on project documents. Features shall include:
      1) Sensitivity: 0 – 100% in 10% increments.
      2) Time Relay: 1 – 30 months.
      3) Test Mode.
      4) Walk-through Mode.
      5) Auto or Manual On (occupancy or vacancy mode).
         a) Provide WattStopper LMD series sensor as indicated on the project documents.

2. Dual Technology (infrared and ultrasonic) occupancy/vacancy wall switch with 1 or 2 buttons.
   a. Wall switch with 1 or 2 pushbuttons as indicated on project documents. Features shall include:
      1) Sensitivity: 0 – 100% in 10% increments.
      2) Time Delay: 1 – 30 minutes.
      3) Test Mode.
      4) Walk-through Mode.
      5) Auto or Manual On (occupancy or vacancy mode).
   b. Provide WattStopper LMD series as indicated on the project drawings.

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3. Digital Room Controllers (ON/OFF or dimming control).
   a. Digital room controllers shall be provided to match room lighting control requirements as indicated on the project drawings.
   b. ON/OFF room controllers shall have the following features:
      1) One, two or three relay configuration.
      2) Integral switching power supply.
   c. ON/OFF/Dimming room controllers shall have the following features:
      1) One, two or three relay configuration.
      2) Integral power supply
      3) One (1) dimming output per relay.
         a) 0 – 10 dimming per relay for control of compatible ballasts and LED drivers.
         b) Each dimming output channel shall be independently configurable.
   d. Provide WattStopper LMRC series digital room controllers as indicated on project documents.

4. Digital Dimming Wall Switch:
   a. Low voltage digital dimming wall switch shall be compatible with the digital room controller. Features shall include:
      1) Dimming switch includes bi-level LED's to indicate load levels.
      2) Full functioning dimming control in multi-way applications such as 3-way, 4-way, etc.
      3) LED status indicator.
   b. Provide WattStopper LMDM series digital dimming wall switch as indicated on the project documents.

5. Digital Wall Switches (ON/OFF).
      1) Low voltage digital wall switch with momentary pushbuttons in 1, 2, 3, 4, 5 & 8 button configurations. Wall switches shall be compatible with the digital room controller and have the following features:
         a) Removable buttons for field replacement.
         b) LED's on each button to confirm status.
         c) Switches may be used for multi-way control applications such as 3-way, 4-way, etc.
   b. Provide WattStopper LMSW series as indicated on the project documents.

6. Emergency Lighting Control Unit (ELCU):
   a. Emergency lighting control unit, a UL 924 listed device that monitors a switched circuit providing Normal lighting to an area. Upon Normal power failure, the emergency lighting circuit will close, forcing the emergency lighting "ON" until Normal power is restored. Features shall include:
      1) 120/277 volts, 50/60 Hz, 200 amp ballast rating.
      2) Push to test button.
      3) Auxiliary contacts for remote test or fire alarm interface.
   b. Provide WattStopper ELCU-100, ELCU-200 as indicated on project documents.

H. Installation:

1. The Electrical Subcontractor shall install all devices and wiring in a professional workmanlike manner per the manufacturer's installation instructions.

2. The Electrical Subcontractor shall test all devices before start-up to ensure proper and correct installation.

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I. The Electrical Subcontractor shall calibrate all sensor time delays and sensitivity settings to ensure proper detection of occupants and energy savings.

1. Adjust sensor settings so that controlled area remains illuminated while occupied.

2.15 TELEPHONE/DATA EMPTY RACEWAYS AND OUTLETS SYSTEM

A. The Electrical Contractor shall furnish and install, complete in every respect, a telephone empty raceway system, all interior raceways, pull boxes, plywood backboards, outlets, outlet cover plate, fittings, and all other appurtenances required, leaving the entire installation ready for installation of telephones, equipment and cables.

B. In general, the telephone system raceways, outlets and terminal backboard locations shall be as shown on the Drawings.

C. All work and the entire installation of same shall be coordinated with the Architectural/ Engineering Coordination Office of the Telephone Company and the Electrical Contractor before the start of the construction and shall be in full conformance with their requirements and recommendations.

D. The Electrical Contractor shall furnish a nylon pull cord in each raceway to facilitate the pulling of cables in the future.

E. All outlet cover plates shall be furnished by the Electrical Contractor. All telephone outlet cover plates shall be blank cover plates of the same finish and by the manufacturer furnishing all other devices and switch plates installed throughout the buildings.

F. Telephone terminal locations are existing and shall be expanded as required as designed on the Drawings. The Electrical Contractor shall furnish and install 3/4 inch thick sheet of plywood backboard for the mounting of equipment and cable terminators by the Telephone Company. The backboards shall be painted with two (2) coats of fire-retardant paint by the Electrical Contractor. Exact dimensions of the backboards shall be as indicated on the Drawings and as required by the Telephone Company.

G. Conduit from telephone outlets indicated on the Drawings shall be installed into the nearest partition, extend a minimum of 6 inches into nearest accessible ceiling space and left ready to be used by the Telephone Company for the installation of their cables.

2.16 COMPUTER EMPTY RACEWAYS AND OUTLETS SYSTEM

A. The Electrical Subcontractor shall furnish and install computer outlets including conduit, outlet box, outlet cover plate, fittings, and all other appurtenances required, leaving the entire installation ready for installation of equipment under a separate Contract.

B. In general, computer outlets and empty conduit locations shall be as shown on the Drawings.

C. The Electrical Subcontractor shall furnish a nylon pull cord in each conduit to facilitate the pulling of cables in the future.

D. All wall plates shall be furnished by the Electrical Contractor. All computer outlet cover plates shall be provided with a blank cover plate and be of the same finish and by the manufacturer furnishing all other device and switch plates installed throughout the renovation.

E. Conduit from computer outlets indicated on the Drawings shall be installed into the nearest partition, extended a minimum of 6 inches into nearest accessible ceiling space and left ready to use for the installation of cables under a separate Contract.

2.17 ACCESS PANELS

A. Provide access panels for access to concealed junction boxes and to other concealed parts of system that require accessibility for operation and maintenance. In general, electrical work shall be laid out so access panels are not required.

B. Access panels shall be located in a workmanlike manner in closets, storage rooms, and/or other non-public areas, positioned so that junction can be easily reached and size shall be sufficient for purpose (minimum size 12” x 16”). When access panels are required in corridors, lobbies, or other habitable areas, they shall be located as directed.

C. Access panels shall be prime-painted and equipped with screwdriver operated cam locks.

D. Acceptable Manufacturers:

1. Inland Steel Products Company – Milcor
2. Miami Carey
3. Walsh-Hannon-Gladwin, Inc. – Way Locator

4. Specific Types:
   a. Acoustical Tile Ceiling “Milcor Type AT”
   b. Plastered Surfaces “Milcor Type K”
   c. Masonry Construction “Milcor Type M”
   d. Drywall Construction “Milcor Type DW”

E. Furnish access panel Shop Drawings.

PART 3 EXECUTION

3.1 BASIC REQUIREMENTS

A. Adhere to best industry practice and the following:

1. All work shall be concealed.

2. Route circuitry runs embedded in concrete to coordinate with structural requirements.

3. Equip each raceway intended for the future installation of wire or cable with a nylon pulling cord 3/16” in diameter and clearly identify both ends of the raceway.

4. Provide all outlet boxes, junction boxes, and pull boxes for proper wire pulling and device installation. Include those omitted from the Drawings due to symbolic methods of notation.

5. Utilize lugs of the limited type to make connections at both ends of cables installed on the line side of main service overcurrent and switching devices. Provide cable limiters for each end of each service entrance cable.

6. Beyond the termination of raceways, fireproof the following:
   a. All wires and cables within pad-mounted transformer enclosure.

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b. All service feeder cables ahead of main service overcurrent protection devices, and elsewhere where not in raceways.
c. Fireproofing of wires and cables shall be by means of a half-lapped layer of arc proof or by means of sleeving of a type specifically manufactured for the purpose. Ends of tape or sleeving shall be severed with twine. Fireproofing shall be extended up into raceways. After conductors have been finally shaped into their permanent configuration, fireproofing tape or sleeving shall be coated with silicate of soda (water glass). Fireproofing shall be applied in an overall manner to raceway groupings of conductors.

7. Provide all sleeves through fireproof and waterproof slabs, walls, etc., required for electric work.
   a. Provide waterproof sealing for the sleeves through waterproof slabs, walls, etc.
   b. Provide fireproof sealing for the sleeves through fireproof walls, slabs, etc.
   c. Provide fireproof sealing for the openings in fireproof walls, slabs, etc., resulting from removal of existing electrical sleeves, conduits, poke-thru's etc.

8. No splicing of wires will be permitted in Fire Alarm System.

9. Bundle wiring passing through pull boxes and panelboards in a neat and orderly manner.

10. Turn branch circuits and auxiliary system wiring out of wiring gutters at 90 degrees to circuit breakers and terminal lugs.

11. In electric rooms with equipment rated 800 amps or more and over 6 feet wide that contains overcurrent devices, the Electrical Contractor shall provide a powered Exit sign at 18" AFF at each door.

12. All building mounted photovoltaic equipment shall be installed, tested and maintained in accordance with NFPA 1 Section 11.12.

13. All panelboards shall be labeled in accordance with NFPA 70 Article 408.

3.2 TESTING REQUIREMENTS & INSTRUCTIONS

A. The Electrical Subcontractor shall provide supervision, labor, materials, tools, test instruments and all other equipment or services and expenses required to test, adjust, set, calibrate, and operationally check work and components of the electrical systems and circuitry throughout Division 16 work.

B. The Electrical Subcontractor shall pay for all tests specified in Division 16, including expenses incident to retests occasioned by defects and failures of equipment to meet Specifications, at no additional cost to the Owner. Any defects or deficiencies discovered in any of the Electrical work shall be corrected.

   1. The Electrical Subcontractor shall:
      a. Replace wiring and equipment found defective (defined as failing to meet specified requirements) at no additional cost to the Owner.
      b. Submit three (3) copies of test results to the Engineer.

   2. Do not void equipment warranties or guarantees by testing and checkout work. Checks and tests shall be supplemental to and compatible with the Manufacturer's installation instructions. Where deviations are apparent, obtain the Manufacturer's approved review of procedures prior to testing. Where any repairs, modifications, adjustments, tests or checks

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are to be made, the Contractor shall contact the Engineer to determine if the work should be performed by or with the Manufacturer's Representative.

3. Tests are to:
   a. Provide initial equipment/system acceptance.
   b. Provide recorded data for future routine maintenance and trouble-shooting.
   c. Provide assurance that each system component is installed satisfactorily and can be expected to perform, and continue to perform its specified function with reasonable reliability throughout the life of the facility.
      1) At any stage of construction and when observed, any electrical equipment or system determined to be damaged, or faulty, is to be reported to the Engineer. Corrective action by the Contractor requires prior Engineer approval, retesting, and inspection.
      2) Prior to testing and start-up, equipment and wiring shall be properly and permanently identified with nameplates, and other identification as specified in Section 3.7. Check and tighten terminals and connection points, remove shipping blocks and thoroughly clean equipment, repair damaged or scratched finishes, inspect for broken and missing parts and review and collect Manufacturer's Drawings and instructions for delivery to the Engineer. Make routine checks and tests as the job progresses to ensure that wiring and equipment is properly installed.
      3) Testing and checkout work is to be performed with fully qualified personnel skilled in the particular tests being conducted. Personnel are to have at least five (5) years of experience with tests of same type and size as specified.
      4) Inspections and tests shall be in accordance with the following applicable codes and standards as amended to date, unless otherwise specified.
         a) National Electrical Manufacturer's Association – NEMA.
         b) American Society for Testing and Materials _ ASTM.
         c) Institute of Electrical and Electronic Engineers – IEEE.
         d) National Electrical Testing Association – NETA.
         e) American National Standards Institute – ANSI.
         f) C2: National Electrical Safety Code.
         g) Z244-1: American National Standard for Personnel Protection.
         h) Insulated Cable Engineers Association – ICEA.
         i) Association of Edison Illuminating Companies – AEIC.
         j) Occupational Safety and Health Administration – OSHA.
         k) OSHA Part 1910; Subpart S, 1910.308.
         l) OSHA Part 1926; Subpart V, 1926.950 through 1926.960.
         m) National Fire Protection Association – NFPA.
         n) 70B: Electrical Equipment Maintenance.
         o) 70E: Electrical Safety Requirements for Employer Workplaces.
         p) 70: National Electrical Code.
         q) 78: Lightning Protection Code.
         r) 101: Life Safety Code.
         s) Inspections and tests shall utilize the following references:
         t) Contract Drawings and Specifications.
         u) Contractor's Short Circuit and Construction Study, in accordance with Section 16100.
         v) Manufacturer's printed test procedures for respective equipment.

4. Test Equipment:
   a. Test equipment used by the Contractor is to be inspected and calibrated.
   b. Perform calibration and setting checks with calibrated test instruments of at least twice that of the accuracy of the equipment, device, relay or meter under test. Dated calibration labels shall be visible on test equipment. Calibrations over six (6) months old are not acceptable on field test instruments. Inspect test instruments for proper operation

prior to proceeding with the tests. Record serial and model numbers of the instruments used on the test forms.

5. Test Procedures:
   a. The Electrical Subcontractor is responsible for the preparation of the procedures and schedules for the work specified herein. This work is to be coordinated and compatible with both the work and schedule of the other crafts. Sequence the tests and checks so that the equipment can be energized immediately after the completion of the application tests.
   b. Submit proposed testing and checkout forms. The procedures shall provide specific instructions for the checking and testing of each electrical component of each system. Schedule tests and inspections as the job progresses. Test procedures submitted shall include job safety rules.
   c. After each electrical system installation is complete, perform the tests to determine that the entire system is in proper working order and in accordance with applicable codes, Manufacturer's instructions, Drawings, and Specifications. Tests are in addition to shop tests of individual items at the Manufacturer's plant. Perform insulation and ground resistance tests before operating tests.
   d. Perform insulation tests on electrical equipment, apparatus, cables, motors, generators, transformers, circuit breakers and switches, switchgear, motor control centers, and similar electrical equipment, at the following items and conditions:
   e. Prior to energization and/or placing into service.
   f. When damage to the insulation is suspected or known to exist.
   g. After repairs or modifications to the equipment affecting the insulation.
   h. Where lightning or other surge conditions are known to have existed on the circuit.
   i. Make openings in circuits for test instruments and place and connect instruments, equipment, and devices, required for the tests. Upon completion of tests, remove instruments and instrument connections and restore circuits to permanent condition.
   j. List each circuit and measured resistance as test data. Maintain record of insulation resistance values. Identify conductor, or equipment, date that value was taken and resistance value. Arrange information in tabular form and submit to Engineer.
   k. Report inspections, tests, and calibrations in writing on Engineer approved reports/forms. The recorded data form shall have the signatures of the persons conducting the tests, authorized witnesses and the Engineer. The forms shall serve as the test and inspection checklist.
   l. When the electrical tests and inspections specified or required within Division 16 are completed and results reported, reviewed, and approved by the Engineer, the Contractor may consider that portion of the electrical equipment system or installation electrically complete. The Contractor will then affix appropriate, approved, and dated completion or calibration labels to the tested equipment and notify the Engineer of electrical completion. If the Engineer finds completed work unacceptable, he will notify the Contractor in writing of the unfinished or deficient work, with the reason for his rejection, to be corrected by the Contractor. The Contractor will notify the Engineer in writing when exceptions have been corrected. The Contractor will notify the Engineer in writing when exceptions have been corrected. The Contractor will prepare a "Notification or Substantial Electrical Completion" for approval by the Engineer following Engineer's acceptance of electrical completion. If later in-service operation or further testing identified problems attributable to the Contractor, these will be corrected by the Contractor, at no additional cost to the Authority.

C. Specific Tests: Perform the following specified tests. De-energize and isolate equipment and cable prior to performing the tests.

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D. Motors:

1. Before energizing any machine, visually inspect for serviceability. Check Manufacturer's instruction manual for correct lubrication and ventilation. Align motor with driven equipment. Check nameplate for electrical power requirements.

2. Test run motors uncoupled or unloaded, before placing into operation. Check the motor for rotation, speed, current and temperature rise under normal load and record the results. Maintain the proper color codes for phase identifications. This may require swaps at the motor for proper rotation. Use motor phase rotation meter prior to lead connection at motor in order to minimize later swaps.

E. Grounding Systems:

1. Test main building loops and major equipment grounds to remote earth, directly referenced to an extremely low resistance (approximately 1 ohm) reference ground benchmark. Perform a visual inspection of the systems, raceway and equipment grounds to determine the adequacy and integrity of the grounding. Ground testing results shall be recorded, witnesses, and submitted to the Engineer.

2. Perform ground tests using a low resistance, null-balance type ground testing ohmmeter, with test lead resistance compensated for. Use the type of test instrument which compensates for potential and current rod resistances.

3. Test each ground rod and measure ground resistance. If resistance is not 25 ohms or less, drive additional rods to obtain a resistance of 25 ohms or less. Submit tabulation of results to Engineer. Include identification of electrode, date of reading and ground resistance valve in the test reports.

4. Test each building and major equipment grounding system for continuity of connections and for resistance. Ground resistance of conduits, equipment cases, and supporting frames, shall not exceed 5 ohms to ground. Submit all readings to the Engineer.

5. Where ground test results identify the need for additional grounding conductors or rods that are not indicated or specified, design changes will be initiated to obtain the acceptable values. The Contractor is responsible for the proper installation of the grounding indicated and specified.

6. Wire and Cable: (All conductors originating from main switchboard and distribution panels).
   a. Before energizing any cable or wire, megger the insulation resistance of every external circuit wire to each other and to ground. Tests shall be conducted at voltages of 500 volts or lower. Continuity test each wire and cable to verify the field-applied tag per conductor. Continuity test each wire and cable to verify the field-applied tag per conductor. Minimum insulation resistance valves shall not be less than two (2) megohms.
   b. Take insulation resistance measurements for motor feeders. With motors disconnected, measure insulation resistance from load side of contactors or circuit breakers.
   c. Check cables and wires for the proper identification numbering and/or color coding.
   d. Inspect cables for physical damage and proper connection in accordance with single line diagram.

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F. Power Distribution System:

1. Circuit Breakers – Molded Case:
   a. Circuit breaker shall be checked for proper mounting, conductor size and feeder designation.
   b. Operate circuit breaker to ensure smooth operation.
   c. Inspect case for cracks or other defects.
   d. Check tightness of connections with calibrated torque wrench. Refer to manufacturer's instruction for proper torque levels.
   e. Perform a contract resistance test or measure millivolt drop at rated current.
   f. Perform an insulation resistance test at 1000 volts DC for one (1) minute from pole-to-pole and from each pole-to-ground with breaker closed and across open contract in each phase – 500V DC if circuit breaker is solid state.
   g. Adjustable trip breakers shall have minimum pickup current determined by primary current injection where applicable.
   h. Perform long time delay time-current characteristic tests by passing 300% rated current through each pole separately. Determine trip time.
   i. Determine short time pickup and delay by primary current injection if applicable to the particular breaker.
   j. Determine ground fault pickup and time delay by primary current injection if applicable to the particular breaker.
   k. Determine instantaneous pickup currently by primary injection using run-up or pulse method. Clearing times shall be within four (4) cycles.
   l. Verify trip unit reset characteristics.
   m. Perform adjustments for final settings in accordance with breaker setting sheet if applicable to the particular breaker.
   n. Compare contract resistance or millivolt drop valves to adjacent poles and similar breakers. Investigate deviations of more than 50%. Investigate any value exceeding Manufacturer's recommendations.
   o. Insulation resistance shall not be less than 100 megohms.
   p. Trip characteristics of adjustable trip breakers shall fall within Manufacturer's published time-current characteristic tolerance band.
   q. All circuit breakers mounted in switchboards and distribution boards shall be time-current tested by primary current injection where possible, and also any remotely mounted breakers of frame size 400 ampere and larger.
   r. Adjust settings and calibrate all circuit breakers as recommended in the short circuit analysis and coordination study.

2. Motor Control:
   a. Inspect for physical damage, proper anchorage and grounding.
   b. Compare equipment nameplate data with design plans or starter schedule.

3. Motor Running Protection:
   a. Compare overload heater rating with motor full-load current rating to verify proper sizing
   b. If motor running protection is provided by fuses, verify proper rating considering motor characteristics.
   c. Check tightness of bolted connections.
   d. Measure insulation resistance of each bus section phase-to-phase and phase-to-ground for one (1) minute.
   e. Measure insulation resistance of each starter section phase-to-phase and phase-to-ground with the starter contacts closed and the protective device open.
   f. Measure insulation resistance of each control circuit with respect to ground.
   g. Test motor overload units by injecting primary current through overload unit and monitoring trip time at 300% of motor full-load current.

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h. Perform operational tests by initiating control devices to affect proper operation.
i. Bolt torque levels shall be in accordance with Manufacturer's recommendations.
j. Perform insulation resistance test, 1000 VDC minimum test voltage and 100 megohms minimum insulation resistance.
k. Control wiring insulation test voltage shall be 1000 VDC. Manufacturer shall be consulted for test voltage where solid-state control devices are utilized.
l. Perform overload tests at 300% of motor full-load current. Trip times shall be in accordance with Manufacturer's tolerances. Investigate values in excess of 120 seconds.

4. Panelboards:
   a. Inspect for physical damage and proper grounding.
   b. Compare nameplate information with schedules and report any discrepancies.
   c. Inspect all panelboards for cleanliness, workmanship, etc.

5. The following systems shall adhere to the general requirements of this section in addition to complying with the specific test requirements outlined in the respective sections listed:
   a. Fire Alarm System.

6. Operating Instructions: Furnish operating instructions to Owner's designated representative with respect to operations, functions and maintenance procedures for equipment and systems installed. Cost of such instruction up to a full five (5) days of Electrical Subcontractor's time shall be included in contract. Cost of providing a Manufacturer's Representative at site for instructional purposes shall also be included.

3.3 BRANCH CIRCUITRY

A. For all lighting and appliance branch circuitry, raceway sizes shall conform to industry standard maximum permissible occupancy requirements except where these are exceeded by other requirements specified elsewhere.

B. Circuits shall be balanced on phases at their supply as evenly as possible.

C. Feeder connections shall be in the phase rotation which establishes proper operation for all equipment supplied.

D. Reduced size conductors indicated for any feeders shall be taken as their grounding conductors.

E. Feeders consisting of multiple cables and raceways shall be arranged such that each raceway of the feeder contains one (1) cable for each leg and one (1) neutral cable, if any.

F. For circuitry indicated as being protected at 20 Amps or less, abide by the following:

   1. All 20 amp, 120/208 volt, 3-phase, 4-wire combined branch circuit homeruns shall be provided with a #8 AWG neutral conductor.

   2. Minimum conductor size shall be No. 12 AWG copper.

   3. Conductors operating at 120 volts extending in excess of 100 ft. or at 277 volts extending in excess of 200 ft., or the last outlet or fixture tap shall be No. 10 AWG copper throughout.

   4. Lighting fixtures and receptacles shall not be connected to the same circuit.

   5. Circuits shall be balanced on phases at their supply point as evenly as possible.

G. Type MC Cable Installation:

1. Where cable is permitted under the products section, the installation of same shall be done in accordance with code and the following:
   a. Cable shall be supported in accordance with code. Tie wire is not an acceptable means of support. Cable supports such as Caddy WMX-6, MX-3, and clamps such as Caddy 449 shall be used. Where cables are supported by the structure and only need securing in place, then ty-raps will be acceptable. Ty-raps are not acceptable as a means of support. All fittings, hangers, and clamps for support and termination of cables shall be of type specifically designed for use with cable, i.e., romex connectors not acceptable.
   b. Armor of cable shall be removed with rotary cutter device equal to roto-split by Seatek Co.; not with a hacksaw.
   c. Use split “Insuliner” sleeves at terminations.

3.4 REQUIREMENTS GOVERNING ELECTRICAL WORK IN DAMP OR WET LOCATIONS

A. Outlets and outlet size boxes shall be of galvanized cast ferrous metal only.

B. The finish of threaded steel conduit shall be galvanized only.

C. Wires for pulling into raceways for lighting and appliance branch circuitry shall be limited to “THWN”.

D. Wires for pulling into raceways for feeders shall be limited to “THWN”.

E. Plates for toggle switches and receptacles shall have gasketed snap shut covers suitable for wet locations while in use.

F. Final connections of flexible conduit shall be neoprene sheathed.

G. Apply one (1) layer of half looped plastic electric insulating tape over wire nuts used for joining the conductors of wires.

H. Enclosures, junction boxes, pull boxes, cabinets, cabinet trims, wiring troughs and the like, shall be fabricated of galvanized sheet metal, shall conform to the following:

   1. They shall be constructed with continuously welded joints and seams.

   2. Their edges and weld spots shall be factory treated with cold galvanizing compound.

   3. Their connection to circuitry shall be by means of watertight hub connectors with sealing rings.

I. Enclosures for individually mounted switching and overcurrent devices shall be NEMA Class IV weatherproof construction.

J. The covers, doors and plates and trims used in conjunction with all enclosures, pull boxes, outlet boxes, junction boxes, cabinets and the like shall be equipped with gaskets.

K. Panels shall be equipped with doors without exception.

L. The following shall be interpreted as damp or wet locations within building confines:

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1. Spaces where any designations indicating weatherproof (WP) or vapor proof appear on the Drawings.

2. Below waterproofing in slabs applied directly on grade.

3. Spaces defined as wet or damp locations by Article 100 of the National Electric Code.

3.5 IDENTIFICATION AND TAGGING

A. Identify individually:

1. Each panelboard.
2. Each switch and circuit breaker.
3. Each feeder, wire or cable or all systems.
4. Each end of nylon pullwire in empty conduit.

B. Each wire or cable in a feeder shall be identified at its terminal points of connection and in each pullbox, junction box and panel gutter through which it passes.

C. The nomenclature used to identify panelboards or load center shall designate the numbers assigned to them.

D. The nomenclature used to identify switches or circuit breakers shall:

1. Where they disconnect mains or services designate this fact.

2. Where they control feeders, designate the feeder number and the name of the load supplied.

3. Where they control lighting and appliance branch circuitry, designate the name of the space and the load supplied.

E. The nomenclature used to identify feeder wires and cables shall designate the feeder number.

F. Identification for panelboards or load centers shall be by means of engraved Lamacoid nameplates showing 1/4" high white lettering on a black background fastened to the outside face of the front.

G. Identification for switches or circuit breakers shall be by means of the following:

1. Where individually enclosed – engraved Lamacoid nameplates showing 1/8” high white lettering on a black background fastened on the outside front face of the enclosure.

2. Where in panelboards or load centers without doors – same as for individually enclosed.

3. Where in panelboards or load centers with doors – typewritten directories mounted behind transparent plastic covers, in metal frames fastened on the inside face of the doors.

H. Identification for wires and cables shall be by means of wrap around “brady” type labels.

I. Device plates for local toggle switches, toggle switch type motor starters, pilot lights and the like, whose function is not readily apparent shall be engraved with 1/8” high letters suitably describing the equipment controlled or indicated.

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J. Phase identification letters shall be stamped into the metal of the bus bars of each phase of the main busses of each switchboard and each panelboard. The letters shall be visible from at least one (1) “normal posture” location without having to demount any current carrying or supporting elements.

K. Equip the front face of all switchboard pull boxes junction boxes and the like containing cables, busing or devices operating in excess of 600 volts with enameled sheetmetal “red on white” signs reading “DANGER-HIGH VOLTAGE.”

L. Equip all electric closets and the like with enameled sheet metal “red on white” signs reading “Electrical Equipment Room – No Storage Permitted”. Signs shall be mounted at clearly visible locations within the rooms.

M. Provide a sign at the service entrance equipment room indicating the type and location of all on-site emergency or standby power sources.

N. Identify each outlet box, junction box, and cabinet used in conjunction with empty raceway for wires of a future system by means of indelible markings on the inside denoting the system.

O. Prior to installing identifying tags and nameplates, submit their nomenclature for approval. Conform to all revisions issued by the Architect.

3.6 LIMITING NOISE PRODUCED BY ELECTRICAL INSTALLATION

A. Perform the following work in accordance with field instructions issued by the Architect to assure that minimal noise is produced by electrical installations due to equipment furnished as part of the Electrical work.

B. Check and tighten the fastenings of sheet metal plates, covers, doors and trims used in the enclosures of electrical equipment.

C. Remove and replace any individual device containing one or more magnetic flux path metallic cores (e.g., discharge lamp ballast, transformer, reactor, dimmer, solenoid) which is found to have a noise output exceeding that of other identical devices installed at the project.

3.7 SUPPORTS AND FASTENINGS

A. Support work in accordance with best industry standards, Local Electric Code and the following:

1. Include supporting frames or racks for equipment, intended for vertical surface mounting, which is required in a freestanding position.

2. Supporting frames or racks shall be of standard angle, standard channel or specialty support system steel members. They shall be rigidly bolted or welded together and adequately braces to form a substantial structure. Racks shall be of ample size to assure a workmanlike arrangement of all equipment mounted on them.

3. No work intended for exposed installation shall be mounted directly on any building surface. In such locations, flat bar members or spaces shall be used to create a minimum of ¼” air space between the building surfaces and the work. Provide ¾” thick exterior grade plywood painted with two (2) coats of fire-retardant gray paint for mounting of panelboards.

4. Nothing (including outlet, pull and junction boxes and fittings) shall depend on electric conduits, raceways or cables for support.

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5. Nothing shall rest on, or depend for support on, suspended ceiling media.

6. Support less than 2” trade size, vertically run, conduits at intervals no greater than 8’. Support such conduits, 2-1/2” trade size or larger, at intervals no greater than they story height, or 15’, whichever is smaller.

7. Where they are not embedded in concrete, support less than 1” trade size, horizontally run, conduits at intervals no greater than 7’. Support such conduits, 1” trade size or larger, at intervals no greater than 10’.

8. Support all lighting fixtures directly from structural slab, intermediate decking or framing member as directed by the Architect. No light fixtures shall be supported directly from the roof deck.

9. Where fixtures and ceilings are such as to require fixture support from ceiling openings frames, include in the electric work the members necessary to tie back the ceiling opening frames to ceiling suspension members or slabs so as to provide actual support for the fixtures noted above.

10. Support all runs of conduit and/or circuitry directly from structural slabs, intermediate decking or framing members.

11. Fasten electric work to building structure in accordance with the best industry practice.

12. Floor mounted equipment shall not be held in place solely by its own dead weight. Include floor anchor fastenings in all cases.

13. For items which are shown as being ceiling mounted at locations where fastenings to the building construction element above is not possible, provide suitably auxiliary channel or angle iron bridging tying to building structural elements.

14. As a minimum procedure, where weight applied to the attachment points is 100 lbs. or less, fasten to concrete and solid masonry with bolts and expansion shields.

15. As a minimum procedure, where weight applied to building attachment points exceed 100 lbs., but is 300 lbs. or less, conform to the following:
    a. At field poured concrete slabs, utilize inserts with 20’ minimum length slip-through steel rods, set transverse to reinforcing steel.

3.8 SPLICING AND TERMINATING WIRES AND CABLES

A. Maintain all splices and joints in removable cover boxes or cabinets where they may be easily inspected.

B. Locate each completed conductor splice or joint in the outlet box, junction box, or pull box containing it, so that it is accessible from the removal cover side of the box.

C. Join solid conductors No. 8 AWG and smaller by securely twisting them together and soldering, or by using insulated coiled steel spring “wire nut” type connectors. Exclude “wire nuts” employing non-expandable springs. Terminate conductors No. 8 AWG and smaller by means of a neat and fast holding application of the conductors directly to the binding screws or terminals of the equipment or devices to be connected.

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D. Join, tap and terminate standard conductors No. 6 AWG and larger by means of solder sleeves, taps, and lugs with applied solder or by means of bolted saddle type or pressure indent type connectors, taps and lugs. Exclude connectors and lugs of the types which apply set screws directly to conductors. Where equipment or devices are equipped with set screw type terminals which are impossible to change, replace the factory supplied set screws with a type having a ball bearing tip. Apply pressure indent type connectors, taps and lugs utilizing tools manufactured specifically for the purpose and having features preventing their release until the full pressure has been exerted on the lug or connector.

E. Except where wire nuts are used, build up insulation over conductor joints to a value, equal both in thickness and dielectric strength, to that of the factory applied conductor insulation. Insulation of conductor taps and joints shall be by means of half-lapped layers of rubber tape, with an outer layer of friction tape; by means of half-lapped layers of approved plastic electric insulating tape; or by a means of split insulating casings manufactured specifically to insulate the particular connector and conductor, and fastened with stainless steel or non-metallic snaps or clips.

F. Exclude splicing procedures for neutral conductors in lighting and appliance branch circuitry which utilize device terminals as the splicing points.

G. Exclude joints or terminations utilizing solder in any conductors used for grounding or bonding purposes.

H. Exclude all but solder or pressure indent type joints in conductors used for signaling or communication purposes.

I. Lugs for conductors used to make phase leg connections on the line side of the main service overcurrent and switching device shall be of the limiter type.

3.9 PULLING WIRES INTO CONDUITS AND RACEWAYS

A. Delay pulling wires or cables in until the project has progressed to a point when general construction procedures are not liable to injure wires and cables, and when moisture is excluded from raceways.

B. Utilize nylon snakes or metallic fish tapes with ball type heads to set up for pulling. In raceways 2” trade size and larger, utilize a pulling assembly ahead of wires consisting of a suitable brush followed by a 3-1/2” diameter ball mandrel.

C. Leave sufficient slack on all runs of wire and cable to permit the secure connection of devices and equipment.

D. Include circular wedge-type cable supports for wires and cables at the top of any vertical raceway longer than 20 feet. Also include additional supports spaced at intervals which are no greater than 10’. Supports shall be located in accessible pull boxes. Supports shall be of a non-deteriorating insulating material manufactured specifically for the purpose.

E. Pulling lubricants shall be used. They shall be products manufactured specifically for the purpose.

F. Slack on wires and cables located in cabinets and pull boxes shall be formed and set in place in groupings corresponding to their occupancy of raceways. They shall also be arranged, with insulators and supports provided where necessary, such that cable shims or other such temporary expedients do not have to be left permanently in place to prevent the wires and cables from shifting when covers or trims are removed.

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3.10 REQUIREMENTS FOR THE INSTALLATION OF JUNCTION BOXES, OUTLET BOXES AND PULL BOXES

A. Flush wall-mounted outlet boxes shall not be set back to back but shall be offset at least 12” horizontally regardless of any indication on the Drawings.

B. Locate all boxes so that their removable covers are accessible without necessitating the removal of parts of permanent building structure, including piping, ductwork, and other permanent mechanical elements.

C. In conjunction with concealed circuitry, abide by one of the following instructions (as may be applicable to the conditions) in order to assure the aforementioned accessibility. (Not required for circuitry concealed by removable suspended ceiling tiles.)

1. For a small (outlet size) box on circuitry concealed in a partition or wall, locate box or fitting so that its removable cover side, (or the face of any applied raised cover) penetrates through to within 1/8” of the exposed surface of the building materials concealing the circuitry and apply a blank or device plate to suit the functional requirements.

2. For a large box on circuitry concealed in a partition, suspended ceiling, or wall, locate box totally hidden but with its removable cover directly behind an architectural access door or panel (included for the purpose, separate from the electric work) in the building construction which conceals the circuitry.

3. For a small (outlet size) box on circuitry concealed above and intended as an outlet for a surface mounted lighting fixture or other such electrical item, locate box so that its removable cover side penetrates through to the exposed surface of the building materials concealing the circuitry. Arrange the mounting of the lighting fixture or other item so that it completely covers the opening in the building construction caused by the box.

4. For a small (outlet size) box on circuitry concealed in a suspended ceiling, and intended as an outlet for a non-demountable type of recessed lighting fixtures or other such electrical items, locate box totally hidden but with its removable cover not more than 1’ away from the building construction opening occupied by the demountable items.

D. Apply junction and pull boxes in accordance with the following:

1. Include all pull boxes in long straight runs of raceway to assure that cables are not damaged when they are pulled in.

2. Include junction and pull boxes to assure a neat and workmanlike installation of raceways.

3. Include junction and pull boxes to fulfill requirements pertaining to the limitations to the number of bends permitted in raceway between cable access points, the accessibility of cable joints and splices, and the application of cable supports.

4. Include all required junction and pull boxes regardless of indications on the Drawings (which, due to symbolic methods of notation, may omit to show some of them).

E. Apply outlet boxes in accordance with the following:

1. Unless noted below or otherwise specifically indicated, include a separate outlet box for each individual wiring device, lighting fixture and signal or communication system outlet

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component. Outlet boxes supplied attached to lighting fixtures shall not be used as replacements for the boxes specified herein.

2. A continuous row of fixtures of the end-to-end channel type, designed for “through wiring”, and wired in accordance with the specification hereinafter pertaining to circuitry through a series of lighting fixtures, may be supplied through a single outlet box.

3. A series of separate fixtures, designed for “through wiring”, spaced not more than 4’ apart, and inter-connected with conduit or raceway and circuitry which is in accordance with the Specifications hereinafter pertaining to circuitry through a series of lighting fixtures, may be supplied through a single outlet box.

4. Connection to recessed ceiling fixtures supplied with pigtails may be arranged so that more than one (1), but not more than four (4) such fixtures are connected into a single outlet box. When adopting this procedure:
   a. Utilize an outlet box no smaller than 5” square by 2-1/2” deep.
   b. Allow no fixture to be supplied from an outlet box in another room.

5. Multiple local switches indicated at a single location shall be gang-mounted in a single outlet box.

6. Include all required outlet boxes regardless of indications on the Drawings (which due to symbolic methods of notation, may omit to show some of them).

F. Install junction boxes, pull boxes and outlet boxes in conjunction with concealed circuitry.

1. Exclude surface-mounted outlet boxes in conjunction with concealed circuitry.

2. Exclude unused circuitry openings in junction and pull boxes. In larger boxes each such opening shall be closed with a galvanized sheet steel plate fastened with a continuous weld all around. In small outlet type boxes, utilize plugs as specified for such boxes.

3. Close up all unused circuitry openings in outlet boxes. Unused openings in cast boxes shall be closed with approved cast metal threaded plugs. Unused openings in sheet metal boxes shall be closed with sheet metal knock-out plugs.

4. Outlet boxes for switches shall be located at the strike side of doors. Indicate door swings are subject to field change. Outlet boxes shall be located on the basis of final door swing arrangements.

5. Boxes and plaster covers for duplex receptacles shall be arranged for vertical mounting of the receptacle.

6. Equip outlet boxes used for devices which are connected to wires of systems supplied by more than one set of voltage characteristics with barriers to separate the different systems.

G. Barriers in junction and pull boxes of outlet size shall be of the same metal as the box.

1. Barriers in junction and pull boxes which are larger than outlet size shall be of the polyester resin fiberglass of adequate thickness for mechanical strength, but in no case less than 1/4" thick. Each barrier shall be mounted, without fastenings, between angle iron guides so that they may be readily removed.

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3.11 LOCATING AND ROUTING OF CIRCUITRY

A. In general, all circuitry shall be run concealed except that it shall be run exposed where the following conditions occur:

1. Horizontally at the ceiling of permanently unfinished spaces which are not assigned to mechanical or electrical equipment.

2. Horizontally and vertically in mechanical equipment spaces.

3. Horizontally and vertically in electric equipment rooms.

B. Concealed circuitry shall be so located that building construction materials can be applied over its thickest elements without being subject to spalling or cracking.

C. All circuitry and raceways shall not be run within slabs. If field conditions requires raceways to be embedded in field-poured structural building construction concrete fill or slab shall conform to the following:

1. All proposed embedded raceways shall be indicated on plan and elevation and submitted to the Architect and Structural Engineer for review and written approval prior to installation. Any costs associated with the review and approval shall be borne by the Electrical Subcontractor.

2. They shall be run “single layer” with their outside surface no closer than 1” to any surface of the structural concrete.

3. They shall not be located in any configuration which places the outside surface of one closer than 3” to outside surface of another, except at tees, crosses or other single level wide angle junction points.

4. Where crossovers or close grouping are unavoidable, circuitry shall be carefully field coordinated so as not to cause structural weakness.

5. Where turned up or down into a wall or partition they shall, before entering same, be routed parallel for a long enough distance to assure that no relocation of the wall or partition will be necessary to conceal the required bend.

6. They shall be routed in such a manner as to coordinate with the structural requirements of the building.

7. They shall be routed in accordance with field instructions issued by the Architect where such instructions differ from Specifications set forth herein.

D. Circuitry run exposed shall be routed parallel to building walls and column lines.

E. Exposed circuitry located overhead shall be run in a completely accessible manner on the underside of all piping and ductwork.

F. Circuitry run in suspended ceilings shall be routed parallel to building walls, column lines, etc.

G. Circuitry shall be routed so as to prevent electric conductors from being subject to high ambient temperature. Minimum clearances from heated lines or surfaces shall be maintained as follows:

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1. Crossing where uninsulated: 3”.
2. Crossing where insulated: 1”
3. Running parallel where uninsulated: 36”.
4. Running parallel where insulated: 6”.

H. Circuitry shall not be run in elevator shafts, hoistways, and the like. Where outlets for trail cables, pit lights, run be level lights, and the like, are involved, only the “final connection” outlet boxes themselves shall be located within or open into, the confines of the shaft.

I. Circuitry for miscellaneous systems indicated without notation as to location and routing shall be run as per the requirements and notations governing the adjacent light and power circuitry.

3.12 INSTALLING CIRCUITRY

A. The outside surface of circuitry, which is to be embedded in cinder concrete, shall be coated with asphaltum paint.

B. In runs of conduit or raceway including flexible limit the number of bends between cable access points to a total which does not exceed the maximum specified for the particular system. Where no such maximum is specified, limit the number to four (4) right angle bends or the equivalent thereof.

C. In each conduit or raceway assigned for the future pulling in of wires, include a nylon drag cord. In raceways 2” trade size and larger, the cord shall be pulled in utilizing a suitable brush, followed by an 85% diameter ball mandrel ahead of the cord in the pulling assembly. In the event that obstructions are encountered, which will not permit the drag cord to be installed, the blocked section of raceway shall be replaced and any cutting and patching of the structure involved in such replacement shall be included as part of the electric work.

D. Circuitry shall be arranged such that conductors of one feeder or circuitry carrying “going” current are not separated from conductors of the same feeder or circuitry carrying “return” current by any ferrous or other metal. Where not within raceways, all “going” and “return” current conductors of one feeder or circuit shall be laced together so as to minimize induction heating of adjacent metal components.

E. Sleeves used where circuitry is to penetrate waterproof slabs, decks and walls, shall be of a type selected to suit the water condition encountered in the field.

END OF SECTION 26 00 00

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