DeKalb County
GEORGIA

TECHNICAL SPECIFICATIONS

OWNER:	**DEKALB COUNTY GOVERNMENT**
DEPARTMENT:	**DEKALB COUNTY FACILITIES DEPARTMENT** **1300 COMMERCE DRIVE SUITE 300** **DECATUR, GA 30030**
PROJECT NAME:	**DEKALB COUNTY SPLOST** **DEKALB COUNTY FIRE STATION No.7** **1712 COLUMBIA DR.** **DECATUR, GA 30032**

VOLUME I OF I

March 30, 2020

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DEKALB COUNTY FIRE STATION No. 7

INTRODUCTORY INFORMATION

BIDDING REQUIREMENTS

Bidding Requirements (including Invitation to Bids, Instructions to Bidders, and Bid Forms) are issued by the Owner under separate cover and are not included in the Project Manual.

CONTRACTING REQUIREMENTS

Contracting Requirements (including Agreement, General Conditions, Bond, and Certificate Forms) are issued by the Owner under separate cover and are not included in the Project Manual.

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PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

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

B. Related Sections: The following Sections contain requirements that relate to this Section:

1. Division 1 Section "Modification Procedures" for procedures for submitting and handling Change Orders.
2. Division 1 Section "Quality Control Services" for general inspection requirements.
3. Division 2 Section "Earthwork" for procedures for measurement and payment for rock excavation.
4. Division 2 Section "Driven Piles" for procedures for measurement for payment for driven piles.

1.3 DEFINITIONS

A. Unit price is an amount proposed by bidders, stated on the Bid Cost Form, as a price per unit of measurement for materials or services added to or deducted from the Contract Sum by appropriate modification, if the 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, profit, and applicable taxes.

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

D. Schedule: A "Unit Price Schedule" is included at the end of this Section. Specification Sections referenced in the Schedule contain requirements for materials described under each unit price.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 UNIT PRICE SCHEDULE

A. Unit Price No. 1 – Unsuitable Soils (remove and haul off site).

1. Unit of Measurement: Cu. Yard

B. Unit Price No. 2 – Fill Dirt (installed & compacted):

1. Unit of Measurement: Cu. Yard

C. Unit Price No. 3 – Rock (remove and haul off site).

1. Unit of Measurement: Ton

D. Unit Price No. 4 – Fire Water Line (site utility)

1. Unit of Measurement: LF

E. Unit Price No. 5 – Domestic Water Line (site utility)

1. Unit of Measurement: LF

F. Unit Price No. 6 – Storm Sewer Line (site utility)

1. Unit of Measurement: LF

G. Unit Price No. 7 – Sanitary Sewer Line (site utility)

1. Unit of Measurement: LF

H. Unit Price No. 8 – Gas Line (site utility)

1. Unit of Measurement: LF

I. Unit Price No. 9 – Asphalt Paving

1. Unit of Measurement: TON

J. Unit Price No. 10 – Concrete Paving Class B

1. Unit of Measurement: CY

K. Unit Price No. 11 – Concrete Sidewalk

1. Unit of Measurement: CY

L. Unit Price No. 12 – Gravel - GAB

1. Unit of Measurement: CY

M. Unit Price No. 13 – Sanitary Manhole Construction <5’

1. Unit of Measurement: EA

N. Unit Price No. 14 – SS Manhole ADDL depth

1. Unit of Measurement: VF

O. Unit Price No. 15 – Storm Manhole Construction <5’

1. Unit of Measurement: EA

P. Unit Price No. 16 – Storm Manhole ADDL depth

1. Unit of Measurement: VF

Q. Unit Price No. 17 – Traffic Control

1. Unit of Measurement: Hourly

R. Unit Price No. 18 – Traffic Control

1. Unit of Measurement: Daily

END OF SECTION

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section specifies administrative and procedural requirements for handling and processing contract modifications.

1. Multiple Prime Contracts: Provisions of this Section apply to the work of each prime contractor.

B. Related Sections: The following Sections contain requirements that relate to this Section:

1. Division 1 Section "Submittals" for requirements for the Contractor's Construction Schedule.
2. Division 1 Section "Applications for Payment" for administrative procedures governing Applications for Payment.
3. Division 1 Section "Substitutions" for administrative procedures for handling requests for substitutions made after award of the Contract.

1.3 MINOR CHANGES IN THE WORK

A. The Architect will issue supplemental instructions authorizing minor changes in the Work, not involving adjustment to the Contract Sum or Contract Time, on AIA Form G710, Architect's Supplemental Instructions.

1.4 CHANGE ORDER PROPOSAL REQUESTS

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

1. Proposal requests issued by the Architect are for information only. Do not consider them as an instruction either to stop work in progress or to execute the proposed change.
2. Within 10 days of receipt of a proposal request, submit an estimate of cost necessary to execute the change to the Architect for the Owner's review.

a. Include a list of quantities of products required and unit costs, with the total amount of purchases to be made. Where requested, furnish survey data to substantiate quantities.
b. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
c. Include a statement indicating the effect the proposed change in the Work will have on the Contract Time.
d. When work is not performed by Contractors own forces, additionally, submit sub-contractors cost in the same format as indicated directly above.

B. Contractor-Initiated Proposals: When latent or unforeseen conditions require modifications to the Contract, the Contractor may propose changes by submitting a request for a change to the Architect.

1. Include a statement outlining the 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 Contract Time.
2. Include a list of quantities of products required and unit costs, with the total amount of purchases to be made. Where requested, furnish survey data to substantiate quantities.
3. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
4. When work is not performed by Contractors own forces, additionally, submit sub-contractors cost in the same format as indicated directly above.
5. Comply with requirements in Section "Substitutions" if the proposed change requires substitution of one product or system for a product or system specified.

C. Proposal Request Form: Use AIA Document G709 for Change Order Proposal Requests.

1.5 ALLOWANCES

A. Allowance Adjustment: For allowance-cost adjustment, base each Change Order Proposal on the difference between the actual purchase amount and the allowance, multiplied by the final measurement of work-in-place. Where applicable, include reasonable allowances for cutting losses, tolerances, mixing wastes, normal product imperfections, and similar margins.

1. Include installation costs in the purchase amount only where indicated as part of the allowance.
2. When requested, prepare explanations and documentation to substantiate the margins claimed.
3. Submit substantiation of a change in scope of work claimed in the Change Orders related to unit-cost allowances.

4. The Owner reserves the right to establish the actual quantity of work-in-place by independent quantity survey, measure, or count.

B. Submit claims for increased costs because of a change in scope or nature of the allowance described in the Contract Documents, whether for the purchase order amount or the Contractor's handling, labor, installation, overhead, and profit. Submit claims within 21 days of receipt of the Change Order or Construction Change Directive authorizing work to proceed. The Owner will reject claims submitted later than 21 days.

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

1.6 CONSTRUCTION CHANGE DIRECTIVE

A. Construction Change Directive: When the Owner and the Contractor disagree on the terms of a Proposal Request, the Architect may issue a Construction Change Directive on AIA Form G714. The Construction Change Directive instructs the Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order.

1. The Construction Change Directive contains a complete description of the change in the Work. It also designates the method to be followed to determine change in the Contract Sum or 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 the change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract.

1.7 CHANGE ORDER PROCEDURES

A. Upon the Owner's approval of a Proposal Request, the Architect will issue a Change Order for signatures of the Owner and the Contractor on AIA Form G701.

1.8 ADJUSTMENT LIMITATIONS

A. Contractor Overhead and Profit: Unless otherwise specifically indicated in the Agreement, the Contractors markup for overhead and profit shall be limited to 15% when the Work is performed with the Contractors own forces, and 5% markup on work performed by their Subcontractor.
B. Subcontractor Overhead and Profit: Unless otherwise specifically indicated in the Agreement, the Subcontractors markup for overhead and profit shall be limited to 15%.
C. Cost of premiums of Bonds and Insurance: Unless otherwise specifically indicated in the Agreement, the Contractors markup for bond and insurance shall be limited to 2%.
D. Rental cost: Rental cost of machinery and equipment is acceptable, exclusive of hand tools, whether rented from the Contractor or others.
E. Unit Prices: Where unit prices have been provided and agreed, and are used to determine cost of the Work, no markup shall be added.
F. Labor Cost: Unless otherwise specifically indicated in the Agreement, the labor cost shall be no more than the cost determined by Means Cost Estimating values for the trade.
G. Material Cost: Cost of materials, supplies and equipment, including transportation, are acceptable.
H. Time: Where the basis of the change relates to time, in days, the days shall be limited to actual days the Contractor is present at site and working, and shall exclude Holidays and weekends, unless documented evidence supports such claim to Work on weekend or Holiday.
I. All other costs are not acceptable, unless otherwise specifically indicated in the Agreement

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

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

1. Land survey work.
2. Civil-engineering services.
3. Damage surveys.
4. Geotechnical monitoring.

B. Related Sections: The following Sections contain requirements that relate to this Section:

1. Division 1 Section "Coordination" for procedures for coordinating field engineering with other construction activities.
2. Division 1 Section "Submittals" for submitting Project record surveys.
3. Division 1 Section "Project Closeout" for submitting final property survey with Project Record Documents and recording of Owner-accepted deviations from indicated lines and levels.

1.3 SUBMITTALS

A. Certificates: Submit a certificate signed by the land surveyor or professional engineer certifying the location and elevation of improvements.

B. Final Property Survey: Submit 10 copies of the final property survey.

C. Project Record Documents: Submit a record of Work performed and record survey data as required under provisions of "Submittals" and "Project Closeout" Sections.

1.4 QUALITY ASSURANCE

A. Surveyor Qualifications: Engage a land surveyor registered in the state where the Project is located, to perform required land-surveying services.

B. Engineer Qualifications: Engage an engineer of the discipline required, licensed in the state where the Project is located, to perform required engineering services.

C. Architect Qualifications: Engage an Architect, licensed in the state where the Project is located, to perform required Architectural services.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Identification: The Owner will identify existing control points and property line corner stakes.

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

1. Do not change or relocate benchmarks or control points without prior written approval. Promptly report lost or destroyed reference points or requirements to relocate reference points because of necessary changes in grades or locations.
2. Promptly replace lost or destroyed Project control points. Base replacements on the original survey control points.

C. Establish and maintain a minimum of 2 permanent benchmarks on the site, referenced to data established by survey control points.

1. Record benchmark locations, with horizontal and vertical data, on Project Record Documents.

D. Existing Utilities and Equipment: 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 and other construction.

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

3.2 PERFORMANCE

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

1. Advise entities engaged in construction activities of marked lines and levels provided for their use.
2. As construction proceeds, check every major element for line, level, and plumb.

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

1. Record deviations from required lines and levels, and advise the Architect when deviations that exceed indicated or recognized tolerances are detected. On Project Record Drawings, record deviations that are accepted and not corrected.
2. On completion of foundation walls, major site improvements, and other work requiring field-engineering services, prepare a certified survey showing dimensions, locations, angles, and elevations of construction and sitework.

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

D. Building Lines and Levels: Locate and lay out batter boards for structures, building foundations, column grids and locations, floor levels, and control lines and levels required for mechanical and electrical work.

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

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

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

END OF SECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 DEFINITIONS

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

B. "Indicated": The term "indicated" refers to graphic representations, notes, or schedules on the Drawings; or to other paragraphs or schedules in the Specifications and similar requirements in the Contract Documents. Terms such as "shown," "noted," "scheduled," and "specified" are used to help the user locate the reference. Location is not limited.

C. "Directed": Terms such as "directed," "requested," "authorized," "selected," "approved," "required," and "permitted" mean directed by the Architect, requested by the Architect, and similar phrases.

D. "Approved": The term "approved," when used in conjunction with the Architect's action on the Contractor's submittals, applications, and requests, is limited to the Architect's duties and responsibilities as stated in the Conditions of the Contract.

E. "Regulations": The term "regulations" includes laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, as well as rules, conventions, and agreements within the construction industry that control performance of the Work.

F. "Furnish": The term "furnish" means to supply and deliver to the Project site, ready for unloading, unpacking, assembly, installation, and similar operations.

G. "Install": The term "install" describes operations at the Project site including the actual unloading, temporary storage, unpacking, assembling, erecting, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations.

H. "Provide": The term "provide" means to furnish and install, complete and ready for the intended use.

I. "Installer": An installer is the Contractor or another entity engaged by the Contractor, either as an employee, subcontractor, or contractor of lower tier, who performs a particular construction activity including installation, erection, application, or similar operations. Installers are required to be experienced in the operations they are engaged to perform.

1. The term "experienced," when used with the term "installer," means having successfully completed a minimum of 5 previous projects similar in size and scope to this Project; being familiar with the special requirements indicated; and having complied with requirements of authorities having jurisdiction.
2. Trades: Using terms such as "carpentry" does not imply that certain construction activities must be performed by accredited or unionized individuals of a corresponding generic name, such as "carpenter." It also does not imply that requirements specified apply exclusively to tradespeople of the corresponding generic name.
3. Assigning Specialists: Certain Sections of the Specifications require that specific construction activities shall be performed by specialists who are recognized experts in those operations. The specialists must be engaged for those activities, and their assignments are requirements over which the Contractor has no option. However, the ultimate responsibility for fulfilling contract requirements remains with the Contractor.

a. This requirement shall not be interpreted to conflict with enforcing building codes and similar regulations governing the Work. It is also not intended to interfere with local trade-union jurisdictional settlements and similar conventions.

J. "Project site" is the space available to the Contractor for performing construction activities, either exclusively or in conjunction with others performing work as part of the Project. The extent of the Project site is shown on the Drawings and may or may not be identical with the description of the land on which the Project is to be built.

K. "Testing Agencies": A testing agency is an independent entity engaged to perform specific inspections or tests, either at the Project site or elsewhere, and to report on and, if required, to interpret results of those inspections or tests.

1.3 SPECIFICATION FORMAT AND CONTENT EXPLANATION

A. Specification Format: These Specifications are organized into Divisions and Sections based on the Construction Specifications Institute's 16-division format and "Master Format" numbering system.

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

1. Abbreviated Language: Language used in the Specifications and other Contract Documents is abbreviated. Words and meanings shall be interpreted as appropriate. Words implied, but not stated, shall be interpolated as the sense requires. Singular words shall be interpreted as plural and plural words interpreted as singular where applicable as the context of the Contract Documents indicates.
2. Imperative mood and streamlined language are generally used in the Specifications. Requirements expressed in the imperative mood are to be performed by the Contractor. At certain locations in the Text, subjective language is used for clarity to describe responsibilities that must be fulfilled indirectly by the Contractor or by others when so noted.

    a. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.

1.4 INDUSTRY STANDARDS

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

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

C. Conflicting Requirements: Where compliance with 2 or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer uncertainties and requirements that are different but apparently equal to the Architect for a decision before proceeding.

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

D. Copies of Standards: Each entity engaged in construction on the Project must be familiar with industry standards applicable to its construction activity. Copies of applicable standards are not bound with the Contract Documents.

    1. Where copies of standards are needed to perform a required construction activity, the Contractor shall obtain copies directly from the publication source and make them available on request.

E. Abbreviations and Names: Trade association names and titles of general standards are frequently abbreviated. Where abbreviations and acronyms are used in the Specifications or other Contract Documents, they mean the recognized name of the trade association, standards-generating organization, authorities having jurisdiction, or other entity applicable to the context of the text provision. Refer to Gale Research Inc.'s "Encyclopedia of Associations," which is available in most libraries.

1.5 GOVERNING REGULATIONS AND AUTHORITIES

A. Copies of Regulations: Obtain copies of the following regulations and retain at the Project site to be available for reference by parties who have a reasonable need.

1.6 SUBMITTALS

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

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 REFERENCES AND STANDARDS

A. Applicability: The publications listed in the paragraphs of an individual section shall apply only to the extent referenced within the text of that section. Unless the Contract Documents include more stringent requirements, applicable construction industry standards form a part of these specifications and have the same force and effect as if bound or copied directly into the Contract Documents. Publications are referenced within the text by the basic designation only.

B. Copies of Standards: Owner or the Architect will not provide copies of references cited within the specifications. Copies may be obtained directly from publication source.

1.3 DEFINTIONS

A. Furnish: Purchase and deliver to project site, ready for installation.

B. Install: Unpack, assemble, set in final position, fasten in place, make final connections, clean, adjust, and leave ready for use.

C. Provide: Furnish and install.

D. Receive: Accepting a delivery. (Entity responsible for accepting a delivery.)

E. Final Connections: Complete plumbing, mechanical, and electrical connections as required and recommended by manufacturer for optimum operation of equipment.

1.4 WORK COVERED BY CONTRACT DOCUMENTS

A. The Work of this Contract comprises the general construction (site and building) of a new Fire Station with its associated living quarters.

1. Project Location: 1712 Columbia Drive
Decatur, Georgia 30032

1.5 WORK BY OWNER OR SEPARATE CONTRACTORS

A. Owner may award separate contracts for work at the Site, which will be executed concurrent with work of this Contract. Consult and cooperate with separate contractors to the full extent provided for in the Conditions of the Contract.

1.6 WORK SEQUENCE

A. The Work will be conducted in a single phase.

1.7 CONTRACTOR USE OF PREMISES

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

1.8 PRODUCTS ORDERED IN ADVANCE

A. General: This shall be done solely by the General Contractor unless otherwise instructed by the owner.

PART 2 - PRODUCTS (Not Applicable)

PART 3 – EXECUTION (Not Applicable)

END OF SECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes administrative and supervisory requirements necessary for coordinating construction operations including, but not necessarily limited to, the following:

1. General project coordination procedures.
2. Conservation.
3. Coordination Drawings.
4. Administrative and supervisory personnel.
5. Cleaning and protection.

B. Related Sections: The following Sections contain requirements that relate to this Section:

1. Division 1 Section "Project Meetings" for progress meetings, coordination meetings, and pre-installation conferences.
2. Division 1 Section "Submittals" for preparing and submitting the Contractor's Construction Schedule.
3. Division 1 Section "Project Closeout" for coordinating contract closeout.

1.3 COORDINATION

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

1. Schedule construction operations in the sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
2. Coordinate installation of different components to assure maximum accessibility for required maintenance, service, and repair.
3. Make provisions to accommodate items scheduled for later installation.

B. Where necessary, prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and attendance at meetings.

1. Prepare similar memoranda for the Owner and separate contractors where coordination of their work is required.

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

1. Preparation of schedules.
2. Installation and removal of temporary facilities.
3. Delivery and processing of submittals.
4. Progress meetings.
5. Project closeout activities.

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

1. Salvage materials and equipment involved in performance of, but not actually incorporated in, the Work.

1.4 SUBMITTALS

A. Coordination Drawings: Prepare coordination drawings where careful coordination is needed for installation of products and materials fabricated by separate entities. Prepare coordination drawings where limited space availability necessitates maximum utilization of space for efficient installation of different components.

1. Show the relationship of components shown on separate Shop Drawings.
2. Indicate required installation sequences.
3. Comply with requirements contained in Section "Submittals."

B. Staff Names: Within 15 days of commencement of construction operations, submit a list of the Contractor's principal staff assignments, including the superintendent and other personnel in attendance at the Project Site. Identify individuals and their duties and responsibilities. List their addresses and telephone numbers.

1. Post copies of the list in the Project meeting room, the temporary field office, and each temporary telephone.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 GENERAL COORDINATION PROVISIONS

A. Inspection of Conditions: Require the Installer of each major component to inspect both the substrate and conditions under which Work is to be performed. Do not proceed until unsatisfactory conditions have been corrected in an acceptable manner.

B. Coordinate temporary enclosures with required inspections and tests to minimize the necessity of uncovering completed construction for that purpose.

3.2 CLEANING AND PROTECTION

A. Clean and protect construction in progress and adjoining materials in place, during handling and installation. Apply protective covering where required to assure protection from damage or deterioration at Substantial Completion.

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

C. 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. Where applicable, such exposures include, but are not limited to, the following:

1. Excessive static or dynamic loading.
2. Excessive internal or external pressures.
3. Excessively high or low temperatures.
4. Thermal shock.
5. Excessively high or low humidity.
6. Air contamination or pollution.
7. Water or ice.
8. Solvents.
9. Chemicals.
10. Light.
11. Radiation.
12. Puncture.
13. Abrasion.
14. Heavy traffic.
15. Soiling, staining, and corrosion.
16. Bacteria.
17. Rodent and insect infestation.
18. Combustion.
19. Electrical current.
20. High-speed operation.
21. Improper lubrication.
22. Unusual wear or other misuse.
23. Contact between incompatible materials.
24. Destructive testing.
25. Misalignment.
26. Excessive weathering.

27. Unprotected storage.
28. Improper shipping or handling.
29. Theft.
30. Vandalism.

END OF SECTION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

A. This Section specifies administrative and procedural requirements governing the Contractor's Applications for Payment.

B. This Section specifies administrative and procedural requirements governing each prime contractor's Applications for Payment.

1. Coordinate the Schedule of Values and Applications for Payment with the Contractor's Construction Schedule, Submittal Schedule, and List of Subcontracts.

C. Related Sections: The following Sections contain requirements that relate to this Section.

1. Schedules: The Contractor's Construction Schedule and Submittal Schedule are specified in Division 1 Section "Submittals."

1.03 SCHEDULE OF VALUES

A. Coordination: Each prime Contractor shall coordinate preparation of its Schedule of Values for its part of the Work with preparation of the Contractors' Construction Schedule.

1. Correlate line items in the Schedule of Values with other required administrative schedules and forms, including:

a. Contractor's Construction Schedule.
b. Application for Payment forms, including Continuation Sheets.
c. List of subcontractors.
d. Schedule of allowances.
e. Schedule of alternates.
f. List of products.
g. List of principal suppliers and fabricators.
h. Schedule of submittals.

2. Submit the Schedule of Values to the Architect at the earliest possible date

but no later than 10 days before the date scheduled for submittal of the initial Applications for Payment.

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

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

1. Identification: Include the following Project identification on the Schedule of Values:

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

2. Arrange the Schedule of Values in tabular form with separate columns to indicate the following for each item listed:

a. Related Specification Section or Division.
b. Description of 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.

1) Percentage of Contract Sum to nearest one-hundredth percent, adjusted to total 100 percent.

3. Provide a breakdown of the Contract Sum in sufficient detail to facilitate continued evaluation of Applications for Payment and progress reports. Coordinate with the Project Manual table of contents. Break principal subcontract amounts down into several line items.
4. Round amounts to nearest whole dollar; the total shall equal the Contract Sum.
5. Provide a separate line item in the Schedule of Values for each part of the Work where Applications for Payment may include materials or equipment, purchased or fabricated and stored, but not yet installed.

a. Differentiate between items stored on-site and items stored off-site. Include requirements for insurance and bonded warehousing, if required.

6. Provide separate line items on the Schedule of Values for initial cost of the materials, for each subsequent stage of completion, and for total installed value of that part of the Work.
7. Unit-Cost Allowances: Show the line-item value of unit-cost allowances, as a

product of the unit cost, multiplied by the measured quantity. Estimate quantities from the best indication in the Contract Documents.

8. Margins of Cost: Show line items for indirect costs and margins on actual costs only when such items are listed individually in Applications for Payment. Each item in the Schedule of Values and Applications for Payment shall be complete. Include the total cost and proportionate share of general overhead and profit margin 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 the Contractor's option.

9. Schedule Updating: Update and resubmit the Schedule of Values prior to the next Applications for Payment when Change Orders or Construction Change Directives result in a change in the Contract Sum.

1.04 APPLICATIONS FOR PAYMENT

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

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

B. Payment-Application Times: Each progress-payment date is indicated in the Agreement. The period of construction Work covered by each Application for Payment is the period indicated in the Agreement. Where the Agreement does not specifically indicate the period, each progress payment shall be no more than one per month, ending the last day of the month.

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

D. Application Preparation: Complete every entry on the form. Include notarization and execution by a person authorized to sign legal documents on behalf of the Contractor. The Architect will return incomplete applications without action.

   1. Entries shall match data on the Schedule of Values and the Contractor's Construction Schedule. Use updated schedules if revisions were made.
   2. Include amounts of materials and equipment delivered and suitably stored at the site.
   3. Include amounts of Change Orders and Construction Change Directives issued prior to the last day of the construction period covered by the application.

E. Transmittal: Submit 3 signed and notarized original copies of each Application for

Payment to the Architect by a method ensuring receipt within 24 hours. One copy shall be complete, including waivers of lien and similar attachments, when required. Electronic submissions of Applications are not acceptable unless otherwise approved by Owner.

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

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

1. Submit partial waivers on each item for the amount requested, prior to deduction for retainage, on each item.
2. When an application shows completion of an item, submit final or full waivers.
3. The Owner reserves the right to designate which entities involved in the Work must submit waivers.
4. Waiver Delays: Submit each Application for Payment with the Contractor's waiver of mechanics lien for the period of construction covered by the application.

    a. Submit final Applications for Payment with or preceded by 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 waivers of lien on forms, and executed in a manner, acceptable to the Owner.

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

1. List of subcontractors.
2. List of principal suppliers and fabricators.
3. Site Specific Safety Plan per OSHA Requirements
4. Schedule of Values.
5. Contractor's Construction Schedule (preliminary if not final).
6. Schedule of principal products.
7. Schedule of unit prices.
8. Submittal Schedule (preliminary if not final).
9. List of Contractor's staff assignments.
10. List of Contractor's principal consultants.
11. Copies of building permits.
12. Copies of authorizations and licenses from governing authorities for performance of the Work.
13. Initial progress report.
14. Report of preconstruction meeting.

15. Certificates of insurance and insurance policies.
16. Performance and payment bonds.
17. Data needed to acquire the Owner's insurance.
18. Initial settlement survey and damage report, if required.

H. Application for Payment at Substantial Completion: Following issuance of the Certificate of Substantial Completion, submit an Application for Payment.

1. This application shall reflect Certificates of Partial Substantial Completion issued previously for Owner occupancy of designated portions of the Work.
2. Administrative actions and submittals that shall precede or coincide with this application include:

a. Occupancy permits and similar approvals.
b. Warranties (guarantees) and maintenance agreements.
c. Maintenance instructions.
d. Startup performance reports.
e. Changeover information related to Owner's occupancy, use, operation, and maintenance.
f. Final cleaning.
g. Application for reduction of retainage and consent of surety.
h. Advice on shifting insurance coverages.
i. Final progress photographs.
j. List of incomplete Work, recognized as exceptions to Architect's Certificate of Substantial Completion.

I. Final Payment Application: Administrative actions and submittals that must precede or coincide with submittal of the final Application for Payment include the following:

1. Completion of Project closeout requirements (including all hard copy and electronic format documentation).
2. Completion of items specified for completion after Substantial Completion.
3. Ensure that unsettled claims will be settled.
4. Ensure that incomplete Work is not accepted and will be completed without undue delay.
5. Transmittal of required Project construction records to the Owner.
6. Proof that taxes, fees, and similar obligations were paid.
7. Removal of temporary facilities and services.
8. Removal of surplus materials, rubbish, and similar elements.
9. Change of door locks to Owner's access.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION

PART 1 - GENERAL

1.1 DESCRIPTION

A. Work included: To enable orderly review during progress of the Work, and to provide systematic discussion of problems, the Owner will conduct project meetings throughout the construction period.

1.2 QUALITY ASSURANCE

A. For those persons designated by the Contractor to attend and participate in project meetings, provide required authority to commit the Contractor to solutions agreed upon in the project meetings.

1.3 SUBMITTALS

A. Agenda Items: To the maximum extent practicable, advise the Owner at least twenty-four (24) hours in advance of project meetings regarding items to be added to the agenda.

B. Minutes:

1. The Contractor will compile minutes of each project meeting, send to Architect for review and comments prior to distribution, correct minutes per comments, if any, and then will distribute a copy to all meeting attendees and others involved in the project.
2. Recipients of copies may make and distribute such other copies as they wish.

PART 2 - PRODUCTS

(No products are required in this Section)

PART 3 - EXECUTION

3.1 MEETING SCHEDULE

A. Except as noted below for Preconstruction Meeting, Project meetings will be held not less than every other week and may be held weekly if deemed necessary by the Owner.

B. Coordinate as necessary to establish mutually acceptable schedule for meetings.

3.2 MEETING LOCATION

A. The Owner will establish meeting location. To the maximum extent practical, meetings will be held at the job site.

3.3 PRECONSTRUCTION MEETING

A. Preconstruction Meeting will be scheduled to be held not later than ten (10) working days after the Owner has issued the Notice to Proceed.
1. Provide attendance by authorized representatives of the Contractor and major subcontractors.
2. The Owner will advise other interested parties, including the Architect, and invite their attendance.

B. Minimum agenda: Data will be distributed and discussed on at least the following items.
   1. Organizational arrangement of Contractor's forces and personnel, and those of subcontractors, material suppliers and Architect;
   2. Channels and procedures for communications;
   3. Construction schedule, including sequence of critical work;
   4. Contract documents, including distribution of required copies of original documents and revisions;
   5. Processing of Shop Drawings and other data submitted to the Architect for review;
   6. Rules and regulations governing performance of Work;
   7. Procedures for safety and first aid, security, quality control, housekeeping and related matters.

3.4 PROJECT MEETINGS

A. Attendance:
   1. To the maximum extent practicable, assign the same person or persons to represent the Contractor at project meetings throughout progress of the Work.
   2. Subcontractors, material suppliers, and others may be invited to attend those project meetings in which their aspect of the Work is involved.

B. Minimum Agenda:
   1. Review, revise as necessary and approve minutes of previous meetings;
   2. Review progress of the Work since last meeting, including status of submittals for approval;
   3. Identify problems which impede planned progress;
   4. Review pending changes to the Work;
   5. Develop corrective measures and procedures to regain planned schedule;
   6. Complete other current business.

C. Revisions to minutes:
   1. Unless published minutes are challenged in writing prior to the next regularly scheduled progress meeting, they will be accepted as properly stating the activities and decisions of the meeting.
   2. Persons challenging published minutes shall reproduce and distribute copies of the challenge to all indicated recipients of the particular set of minutes.
   3. Challenge to minutes shall be settled as priority portion of "old business" at the next regularly scheduled meeting.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for submittals required for performance of the Work, including the following:

1. Contractor's construction schedule.
2. Submittal schedule.
3. Daily construction reports.
4. Shop Drawings.
5. Product Data.
6. Samples.
7. Quality assurance submittals.

B. Administrative Submittals: Refer to other Division 1 Sections and other Contract Documents for requirements for administrative submittals. Such submittals include, but are not limited to, the following:

1. Permits.
2. Applications for Payment.
3. Performance and payment bonds.
4. Insurance certificates.
5. List of subcontractors.

C. Related Sections: The following Sections contain requirements that relate to this Section:

1. Division 1 Section "Applications for Payment" specifies requirements for submittal of the Schedule of Values.
2. Division 1 Section "Coordination" specifies requirements governing preparation and submittal of required Coordination Drawings.
3. Division 1 Section "Project Meetings" specifies requirements for submittal and distribution of meeting and conference minutes.
4. Division 1 Section "Quality Control" specifies requirements for submittal of inspection and test reports.
5. Division 1 Section "Project Closeout" specifies requirements for submittal of Project Record Documents and warranties at project closeout.

1.3 DEFINITIONS

A. Coordination Drawings show the relationship and integration of different construction elements that require careful coordination during fabrication or installation to fit in the space provided or to function as intended.

1. Preparation of Coordination Drawings is specified in Division 1 Section "Coordination" and may include components previously shown in detail on Shop Drawings or Product Data.

B. Field samples are full-size physical examples erected on-site to illustrate finishes, coatings, or finish materials. Field samples are used to establish the standard by which the Work will be judged.

C. Mockups are full-size assemblies for review of construction, coordination, testing, or operation; they are not Samples.

1.4 SUBMITTAL PROCEDURES

A. Coordination: Coordinate preparation and processing of submittals with performance of construction activities. Transmit each submittal sufficiently in advance of performance of related construction activities to avoid delay.

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

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

3. Processing: To avoid the need to delay installation as a result of the time required to process submittals, allow sufficient time for submittal review, including time for resubmittals.

    a. **Allow 2 weeks for initial review.** Allow additional time if the Architect must delay processing to permit coordination with subsequent submittals.
    b. If an intermediate submittal is necessary, process the same as the initial submittal.
    c. **Allow 2 weeks for reprocessing each submittal.**
    d. No extension of Contract Time will be authorized because of failure to transmit submittals to the Architect sufficiently in advance of the Work to permit processing.

B. Submittal Preparation: Place a permanent label or title block on each submittal for identification. Indicate the name of the entity that prepared each submittal on the label or title block.

1. Provide a space approximately 4 by 5 inches (100 by 125 mm) on the label or beside the title block on Shop Drawings to record the Contractor's review and approval markings and the action taken.
2. Include the following information on the label for processing and recording action taken.

    a. Project name.
    b. Date.

c. Name and address of the Architect.
d. Name and address of the Contractor.
e. Name and address of the subcontractor.
f. Name and address of the supplier.
g. Name of the manufacturer.
h. Number and title of appropriate Specification Section.
i. Drawing number and detail references, as appropriate.

C. Submittal Transmittal: Package each submittal appropriately for transmittal and handling. Transmit each submittal from the Contractor to the Architect using a transmittal form. **The Architect will not accept submittals received from sources other than the Contractor.** Electronic submittals will be acceptable in PDF format with the exception of SAMPLES. However, the submittal shall follow the procedures indicated above and below.

1. On the transmittal, record relevant information and requests for data. On the form, or separate sheet, record deviations from Contract Document requirements, including variations and limitations. Include Contractor's certification that information complies with Contract Document requirements.
2. Transmittal Form: Use AIA Document G810.

1.5 CONTRACTOR'S CONSTRUCTION SCHEDULE

A. Bar-Chart Schedule: Prepare a fully developed, horizontal bar-chart-type, contractor's construction schedule. Submit within 30 days after the date established for "Commencement of the Work."

1. Provide a separate time bar for each significant construction activity. Provide a continuous vertical line to identify the first working day of each week. Use the same breakdown of units of the Work as indicated in the "Schedule of Values."
2. Within each time bar, indicate estimated completion percentage in 10 percent increments. As Work progresses, place a contrasting mark in each bar to indicate Actual Completion.
3. Prepare the schedule on a sheet, or series of sheets, of stable transparency, or other reproducible media, of sufficient width to show data for the entire construction period.
4. Secure time commitments for performing critical elements of the Work from parties involved. Coordinate each element on the schedule with other construction activities; include minor elements involved in the sequence of the Work. Show each activity in proper sequence. Indicate graphically the sequences necessary for completion of related portions of the Work.
5. Coordinate the Contractor's Construction Schedule with the Schedule of Values, list of subcontracts, Submittal Schedule, progress reports, payment requests, and other schedules.
6. Indicate completion in advance of the date established for Substantial Completion. Indicate Substantial Completion on the schedule to allow time for the Architect's procedures necessary for certification of Substantial Completion.

B. Phasing: On the schedule, show how requirements for phased completion to permit Work by separate Contractors and partial occupancy by the Owner affect the sequence of Work.

C. Work Stages: Indicate important stages of construction for each major portion of the Work, including submittal review, testing, and installation.

D. Area Separations: Provide a separate time bar to identify each major construction area for each major portion of the Work. Indicate where each element in an area must be sequenced or integrated with other activities.

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

1. Refer to Division 1 Section "Applications for Payment" for cost reporting and payment procedures.

F. Distribution: Following response to the initial submittal, print and distribute copies to the Architect, Owner, subcontractors, and other parties required to comply with scheduled dates. Post copies in the Project meeting room and temporary field office.

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

G. Schedule Updating: Revise the schedule after each meeting, event, or activity where revisions have been recognized or made. Issue the updated schedule concurrently with the report of each meeting.

1.6 SUBMITTAL SCHEDULE

A. After development and acceptance of the Contractor's Construction Schedule, prepare a complete schedule of submittals. Submit the schedule within 10 days of the date required for submittal of the Contractor's Construction Schedule.

1. Coordinate Submittal Schedule with the list of subcontracts, Schedule of Values, and the list of products as well as the Contractor's Construction Schedule.
2. Prepare the schedule in chronological order. Provide the following information:

a. Scheduled date for the first submittal.
b. Related Section number.
c. Submittal category (Shop Drawings, Product Data, or Samples).
d. Name of the subcontractor.
e. Description of the part of the Work covered.
f. Scheduled date for resubmittal.
g. Scheduled date for the Architect's final release or approval.

B. Distribution: Following response to the initial submittal, print and distribute copies to the Architect, Owner, subcontractors, and other parties required to comply with submittal dates indicated. Post copies in the Project meeting room and field office.

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

C. Schedule Updating: Revise the schedule after each meeting or activity where revisions have been recognized or made. Issue the updated schedule concurrently with the report of each meeting.

1.7 DAILY CONSTRUCTION REPORTS

A. Prepare a daily construction report recording the following information concerning events at the site, and submit duplicate copies to the Architect at weekly intervals:

1. List of subcontractors at the site.
2. Approximate count of personnel at the site.
3. High and low temperatures, general weather conditions.
4. Accidents and unusual events.
5. Meetings and significant decisions.
6. Stoppages, delays, shortages, and losses.
7. Meter readings and similar recordings.
8. Emergency procedures.
9. Orders and requests of governing authorities.
10. Change Orders received, implemented.
11. Services connected, disconnected.
12. Equipment or system tests and startups.
13. Partial Completions, occupancies.
14. Substantial Completions authorized.

1.8 SHOP DRAWINGS

A. Submit newly prepared information drawn accurately to scale. Highlight, encircle, or otherwise indicate deviations from the Contract Documents. Do not reproduce Contract Documents or copy standard information as the basis of Shop Drawings. Standard information prepared without specific reference to the Project is not a Shop Drawing.

B. Shop Drawings include fabrication and installation Drawings, setting diagrams, schedules, patterns, templates and similar Drawings. Include the following information:

1. Dimensions.
2. Identification of products and materials included by sheet and detail number.
3. Compliance with specified standards.
4. Notation of coordination requirements.
5. Notation of dimensions established by field measurement.
6. Sheet Size: Except for templates, patterns and similar full-size Drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches (215 by 280 mm) but no larger than 36 by 48 inches (890 by 1220 mm).
7. Initial Submittal: Submit 2 blue- or black-line prints for the Architect's review. The Architect will return one print.
9. Final Submittal: Submit 3 blue- or black-line prints; submit 5 prints where required for maintenance manuals. The Architect will retain 2 prints and return the remainder.
10. Do not use Shop Drawings without an appropriate final stamp indicating action taken.

11. In lieu of hard copies, it is acceptable to submit Shop Drawings complying with the above requirements, in electronic format (PDF's) via email directly to the Architect's Project Manager.

1.9 PRODUCT DATA

A. Collect Product Data into a single submittal for each element of construction or system. Product Data includes printed information, such as manufacturer's installation instructions, catalog cuts, standard color charts, roughing-in diagrams and templates, standard wiring diagrams, and performance curves.

1. Mark each copy to show applicable choices and options. Where printed Product Data includes information on several products that are not required, mark copies to indicate the applicable information. Include the following information:

    a. Manufacturer's printed recommendations.
    b. Compliance with trade association standards.
    c. Compliance with recognized testing agency standards.
    d. Application of testing agency labels and seals.
    e. Notation of dimensions verified by field measurement.
    f. Notation of coordination requirements.

2. Do not submit Product Data until compliance with requirements of the Contract Documents has been confirmed.
3. Preliminary Submittal: Submit a preliminary single copy of Product Data where selection of options is required.
4. Submittals: Submit 5 copies of each required submittal; submit 4 copies where required for maintenance manuals. The Architect will retain one and will return the other marked with action taken and corrections or modifications required. In lieu of hard copies, it is acceptable to submit product data complying with requirements of paragraphs 1-3 above, in electronic format (PDF's) via email directly to the Architect's Project Manager.

    a. Unless noncompliance with Contract Document provisions is observed, the submittal may serve as the final submittal.

5. Distribution: Furnish copies of final submittal to installers, subcontractors, suppliers, manufacturers, fabricators, and others required for performance of construction activities. Show distribution on transmittal forms.

    a. Do not proceed with installation until a copy of Product Data is in the Installer's possession.
    b. Do not permit use of unmarked copies of Product Data in connection with construction.

1.10 SAMPLES

A. Submit full-size, fully fabricated Samples cured and finished as specified and physically identical with the material or product proposed. Samples include partial sections of manufactured or fabricated components, cuts or containers of materials, color range sets, and swatches showing color, texture, and pattern.

1. Mount or display Samples in the manner to facilitate review of qualities indicated. Prepare Samples to match the Architect's sample. Include the following:

    a. Specification Section number and reference.
    b. Generic description of the Sample.
    c. Sample source.
    d. Product name or name of the manufacturer.
    e. Compliance with recognized standards.
    f. Availability and delivery time.

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

    a. Where variation in color, pattern, texture, or other characteristic is inherent in the material or product represented, submit at least 3 multiple units that show approximate limits of the variations.
    b. Refer to other Specification Sections for requirements for Samples that illustrate workmanship, fabrication techniques, details of assembly, connections, operation, and similar construction characteristics.
    c. Refer to other Sections for Samples to be returned to the Contractor for incorporation in the Work. Such Samples must be undamaged at time of use. On the transmittal, indicate special requests regarding disposition of Sample submittals.
    d. Samples not incorporated into the Work, or otherwise designated as the Owner's property, are the property of the Contractor and shall be removed from the site prior to Substantial Completion.

3. Preliminary Submittals: Submit a full set of choices where Samples are submitted for selection of color, pattern, texture, or similar characteristics from a range of standard choices.

    a. The Architect will review and return preliminary submittals with the Architect's notation, indicating selection and other action.

4. Submittals: Except for Samples illustrating assembly details, workmanship, fabrication techniques, connections, operation, and similar characteristics, submit 5 sets. The Architect will return 2 sets marked with the action taken.
5. Maintain sets of Samples, as returned, at the Project Site, for quality comparisons throughout the course of construction.

    a. Unless noncompliance with Contract Document provisions is observed, the submittal may serve as the final submittal.
    b. Sample sets may be used to obtain final acceptance of the construction associated with each set.

B. Distribution of Samples: Prepare and distribute additional sets to subcontractors, manufacturers, fabricators, suppliers, installers, and others as required for performance of the Work. Show distribution on transmittal forms.

1. Field samples are full-size examples erected on-site to illustrate finishes, coatings, or finish materials and to establish the Project standard.

a. Comply with submittal requirements to the fullest extent possible. Process transmittal forms to provide a record of activity.

1.11 QUALITY ASSURANCE SUBMITTALS

A. Submit quality-control submittals, including design data, certifications, manufacturer's instructions, manufacturer's field reports, and other quality-control submittals as required under other Sections of the Specifications, or on Drawings if not in Master Specification book.

B. Certifications: Where other Sections of the Specifications require certification that a product, material, or installation complies with specified requirements, submit a notarized certification from the manufacturer certifying compliance with specified requirements.

1. Signature: Certification shall be signed by an officer of the manufacturer or other individual authorized to sign documents on behalf of the company.

C. Inspection and Test Reports: Requirements for submittal of inspection and test reports from independent testing agencies are specified in Division 1 Section "Quality Control."

1.12 ARCHITECT'S ACTION

A. Except for submittals for the record or information, where action and return is required, the Architect will review each submittal, mark to indicate action taken, and return promptly.

1. Compliance with specified characteristics is the Contractor's responsibility.

B. Action Stamp: The Architect will stamp each submittal with a uniform, action stamp. The Architect will mark the stamp appropriately to indicate the action taken, as follows:

1. Final Unrestricted Release: When the Architect marks a submittal "No Exceptions Taken," the Work covered by the submittal may proceed provided it complies with requirements of the Contract Documents. Final payment depends on that compliance.
2. Final-But-Restricted Release: When the Architect marks a submittal "Exceptions as Noted," the Work covered by the submittal may proceed provided it complies with notations or corrections on the submittal and requirements of the Contract Documents. Final payment depends on that compliance.
3. Returned for Resubmittal: When the Architect marks a submittal "Revise and Resubmit," do not proceed with Work covered by the submittal, including purchasing, fabrication, delivery, or other activity. Revise or prepare a new submittal according to the notations; resubmit without delay. Repeat if necessary to obtain different action mark.

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

4. Not Approved: When the Architect marks a submittal "Rejected" do not proceed with Work covered by the submittal, including purchasing, fabrication, delivery, or other activity. Prepare a new submittal.

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

5. Supplementary Submittal: When the Architect marks a submittal “Submit Specified Item” submit the exact item as indicated in Contract Documents.

6. Other Action: Where a submittal is for information or record purposes or special processing or other activity, the Architect will return the submittal to sender without action.

C. Unsolicited Submittals: The Architect will discard unsolicited submittals without action and notify sender in writing (including email) that submittal was unsolicited.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Testing and inspecting services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.
   1. Contractor shall provide, at his/her expense, all testing and inspecting services.
   2. Contractor is responsible for scheduling inspections and tests and notifying testing agency.
   3. Retesting and Reinspecting: Contractor shall pay for additional testing and inspecting required as a result of tests and inspections indicating noncompliance with requirements.

B. Performance and Design Criteria: Where design services or certifications by a professional engineer are required by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.
   1. If criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to Architect.
   2. 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.

C. Submittals: Testing agency shall submit a certified written report of each inspection and test to Owner, Architect, Contractor, structural engineer, and to authorities having jurisdiction when authorities so direct. Reports of each inspection, test, or similar service shall include the following:
   1. Name, address, and telephone number of testing agency.
   2. Project title and testing agency's project number.
   3. Date of report and designation (number).
   4. Dates and locations where samples were taken or inspections and field tests made.
   5. Ambient conditions at the time of sample taking and inspecting or field testing.
   6. Names of individuals taking the sample or making the inspection or test.
   7. Product and test method.
   8. Inspection or test data including interpretation of test results and comments or professional opinion on whether inspected or tested Work complies with requirements.
   9. Recommendations on retesting or reinspection.
   10. Name and signature of laboratory inspector.

D. Testing Agency Qualifications: Agencies that specialize in the types of inspections and tests to be performed and are acceptable to authorities having jurisdiction.

E. Testing Agency Responsibilities: Testing agency shall cooperate with Architect and Contractor in performing its duties and shall provide qualified personnel to perform inspections and tests.
   1. Agency shall promptly notify Architect and Contractor of deficiencies in the Work observed during performance of its services.
   2. Agency shall not release, revoke, alter, or enlarge requirements of the Contract Documents nor approve or accept any portion of the Work.
   3. Agency shall not perform duties of Contractor.

F. Auxiliary Services: Cooperate with testing agencies and provide auxiliary services as requested, including the following:

   1. Access to the Work.

2. Incidental labor and facilities to assist inspections and tests.
3. Adequate quantities of materials for testing, and assistance in taking samples.
4. Facilities for storing and curing test samples.
5. Security and protection for samples and test equipment.

1.2 TESTING AND INSPECTION SERVICES

A Testing and inspecting services are not limited to the items listed below. Contractor shall provide all testing and inspecting services specified below and in other Sections of these Specifications or the Drawings, or are required by authorities having jurisdiction and shall be performed by independent testing agencies. Contractor shall engage an independent testing agency service per the qualifications indicated above. Reports of these tests shall be documented and distributed in accordance with the above stated requirements.

B. The following tests and inspections are required:
1 Division 2 Site Work, Base: to conform to the recommendations of the soils report.
2 Division 2 Site Work, Hot-Mix Asphaltic Paving: to conform to the standards and materials as indicated on the drawings.
3 Division 2 Site Work, Portland Cement Paving: to conform to the standards and materials as indicated on the drawings.
4 Abatement Clearance testing.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes administrative and procedural requirements governing the Contractor's selection of Information Technology vendors for use in the Project.

1. Subcontractors Contracts: Provisions of this Section apply to the construction activities of each subcontractor.

1.3 SECTION REQUIREMENTS

A. Scheduling and Coordination for the installation of all information technology systems (including but not limited to low voltage electrical for cable, telephone, data, fiber, SAN, security cameras, and speakers) shall be the responsibility of the Contractor.

1. Contractor shall provide all conduits and boxes for the Work.

B. Contractor shall coordinate work with Owners vendor/installer

1. Contractor shall schedule and conduct an IT coordination meeting within 30 days of Notice to Proceed. All vendors and service providers shall be invited to attend this meeting.
2. Contractor shall provide meeting minutes from the meeting and distribute to Owner and Architect.

PART 2 - PRODUCTS

A. Products provided by Contractor:

1. Speakers: Horn type. Zoro PA Weatherproof Speaker, or approved equal
   a. Size: 7-1/4”
   b. Quantity: 4 minimum, unless greater quantity is indicated on the drawings
   c. Finish: Aluminum
2. Speakers: Ceiling mounted: Zoro Speaker Transformer with Volume control, or approved equal
   a. Size: 8”
   b. Quantity: 40 minimum, unless greater quantity is indicated on the drawings
   c. Conduit size shall be a minimum of one inch, unless otherwise noted on the drawings.
3. Security Cameras: TBD
   a. Quantity: 8 minimum
4. Other Building and Site: Conduit size shall be a minimum of three inches for site and one inch for building, unless otherwise noted on the drawings.
   a. Site quantities of conduit: two lines from local utility pole to IT closet maximum 500 feet quantified after installation.

b. Building quantities of conduit for cable, telephone, data, fiber, SAN, security cameras, access control devices and speakers; and any other devices indicated on the drawings: as necessary to provide complete working system.

5. All conduits shall be routed from device (within building and/or on site) to IT closet, unless otherwise noted on the drawings.

B. Contractor shall coordinate work with Owners vendor/installer

PART 3 - EXECUTION

3.1 INSTALLATION OF PRODUCTS

A. Comply with manufacturer's instructions and recommendations for installation of products in the applications indicated. Anchor each product securely in place, accurately located and aligned with other Work.

1. Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.

END OF SECTION

PART 1 - GENERAL

1.1 DESCRIPTION

A. Work included: Provide temporary facilities and controls needed for the Work including, but not necessarily limited to:
   1. Temporary utilities such as heat, water, electricity and telephone;
   2. Field office for the Contractor's personnel and area for meetings with Owner and Architect or Owner's other Consultants;
   3. Sanitary facilities;
   4. Temporary barriers of the construction site;
   5. Project sign – Sign shall be approved and include the Owner and Architect's information.

B. Related Work:
   1. Except that equipment furnished by Subcontractors shall comply with requirements of pertinent safety regulations, such equipment normally furnished by the individual trades in execution of their own portions of the Work are not part of this Section.

1.2 PRODUCT HANDLING

A. Maintain temporary facilities and controls in proper and safe conditions throughout progress of the Work.

PART 2 - PRODUCTS

2.1 UTILITIES

A. General: The Contractor shall provide water and electrical power utility service required by the Work.

B. Water:

1. Provide necessary temporary piping and water supply and, upon completion of the Work, remove such temporary facilities.

C. Electricity:
   1. Provide necessary temporary wiring and, upon completion of the Work, remove such temporary facility.
   2. Provide area distribution boxes so located that the individual trades may furnish and use 100 ft. maximum length extension cords to obtain power and lighting at points where needed for Work, inspection and safety.

D. Telephone:
   1. Make necessary arrangements and pay costs for installation and operation of telephone service to the Contractor's office at the site.
   2. Make the telephone available to the Architect and Owner for use in connection with the Work.

2.2 FIELD OFFICES AND SHEDS

A. Contractor's facilities:
   1. Provide a field office building and sheds adequate in size and accommodation for Contractor's offices, supply and storage.

2. Within the Contractor's facilities, provide enclosed space adequate for holding project meetings. Furnish with table, chairs and utilities.

B. Sanitary facilities:
1. Provide temporary sanitary facilities in the quality required for use by all personnel.
2. Maintain in a sanitary condition at all times.

2.3 ENCLOSURES

A. Provide and maintain for the duration of construction all scaffolds, tarpaulins, canopies, warning signs, steps, platforms, bridges, and other temporary construction necessary for proper completion of the Work in compliance with pertinent safety and other regulations.

2.4 TEMPORARY BARRIERS

A. Provide and maintain for the duration of construction a temporary barrier as required, of design and type needed to prevent entry onto the Work by the public. Install and maintain thereon "Hazardous Area" signs sufficient to warn the public.
1. Provide 6 foot high chain link fence.

B. Provide and maintain pedestrian access in row or provide temporary sidewalks to replace existing as needed. Contractor shall maintain the publics access to MARTA bus stop.

2.5 PROJECT SIGNS

A. Prior to start of construction, submit proposed Project sign layout to the Architect for approval.
1. Furnish and install a minimum of one (1) Project Sign.
2. Project sign shall include the name and logo of Architect and Owner.
3. Mount Sign at job site where directed by Architect and Owner.
4. Except as otherwise specifically approved by the Owner, do not permit other signs or advertising on the job site.
5. Project sign shall be erected on site within 14 days of NTP.
6. Project sign shall be no less that 4' x 8'. Double sided.

B. Manufacturer:
1. A+Signs. Decatur, GA.
2. FAST SIGNS, Smyrna, GA.
3. FAST SIGNS, Tucker, GA.
4. FruArt, Decatur, GA.
5. Rapid Signs, Atlanta, GA
6. Other manufacturers who provide the specified sign type.

C. Materials:
1. 96 in. x 48 in. x ¾ in. Plywood.
2. Weather resistant Paint & vinyl coatings.
3. 4 x 4 Wood Lumber. Provide other lumber as required by contractor's design for sign support
4. Fasteners

D. Execution:
1. Embed wood lumber post in ground. Mount sing to posts. Brace with wood lumber as necessary.
2. Install sign erect and plumb.

3. Maintain sign installation throughout project duration.
4. Remove sign when directed by Owner.

2.6 TRANSPORTATION FACILITIES

A. Truck and equipment access:
   1. To avoid traffic conflict with vehicles of the Owner's employees, and to avoid overloading of streets and driveways elsewhere on the Owner's property, limit the access of trucks and equipment to the ACCESS ROUTE as directed by the Architect.
   2. Provide adequate protection for curbs and sidewalks over which trucks and equipment pass to reach the job site.

B. Remove such temporary facilities and controls as rapidly as progress of the Work will permit, or as directed by the Architect.

PART 3 - EXECUTION

3.1 SECURITY

A. Restrict the access of all persons entering upon the Owner's property in connection with the Work to the Access Route and to the actual site of the Work. The Contractor is responsible for providing adequate security to the building and its contents during the construction period. When school is in session and the Contractor is on the premises, the Owner and Contractor will be jointly responsible for security of the building. When the Contractor is on the premises after school hours and no owner's representative is on the premises, the Contractor will be fully responsible for security.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes administrative and procedural requirements governing the Contractor's selection of products for use in the Project.

1. Multiple Prime Contracts: Provisions of this Section apply to the construction activities of each prime contractor.

B. Related Sections: The following Sections contain requirements that relate to this Section:

1. Division 1 Section "Reference Standards and Definitions" specifies the applicability of industry standards to products specified.
2. Division 1 Section "Submittals" specifies requirements for submittal of the Contractor's Construction Schedule and the Submittal Schedule.
3. Division 1 Section "Substitutions" specifies administrative procedures for handling requests for substitutions made after award of the Contract.

1.3 DEFINITIONS

A. Definitions used in this Article are not intended to change the meaning of other terms used in the Contract Documents, such as "specialties," "systems," "structure," "finishes," "accessories," and similar terms. Such terms are self-explanatory and have well-recognized meanings in the construction industry.

1. "Products" are items purchased for incorporation in the Work, whether purchased for the Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.

    a. "Named Products" are items identified by the manufacturer's product name, including make or model number or other designation, shown or listed in the manufacturer's published product literature that is current as of the date of the Contract Documents.
    b. "Foreign Products," as distinguished from "domestic products," are items substantially manufactured (50 percent or more of value) outside the United States and its possessions. Products produced or supplied by entities substantially owned (more than 50 percent) by persons who are not citizens of, nor living within, the United States and its possessions are also considered to be foreign products.

2. "Materials" are products substantially shaped, cut, worked, mixed, finished, refined or otherwise fabricated, processed, or installed to form a part of the Work.
3. "Equipment" is a product with operational parts, whether motorized or manually operated, that requires service connections, such as wiring or piping.

1.4 SUBMITTALS

A. Product List: Prepare a schedule in tabular form showing each product used in the project. Include the manufacturer's name and proprietary product names for each item listed.

B. Product List: Prepare a list showing products specified in tabular form acceptable to the Architect. Include generic names of products required. Include the manufacturer's name and proprietary product names for each item listed.

1. Coordinate product list with the Contractor's Construction Schedule and the Schedule of Submittals.
2. Form: Prepare product list with information on each item tabulated under the following column headings:

    a. Related Specification Section number.
    b. Generic name used in Contract Documents.
    c. Proprietary name, model number, and similar designations.
    d. Manufacturer's name and address.
    e. Supplier's name and address.
    f. Installer's name and address.
    g. Projected delivery date or time span of delivery period.

3. Initial Submittal: Within 30 days after date of commencement of the Work, submit 3 copies of an initial product list. Provide a written explanation for omissions of data and for known variations from Contract requirements.

    a. At the Contractor's option, the initial submittal may be limited to product selections and designations that must be established early in the Contract period.

4. Completed List: Within 60 days after date of commencement of the Work, submit 3 copies of the completed product list. Provide a written explanation for omissions of data and for known variations from Contract requirements.
5. Architect's Action: The Architect will respond in writing to Contractor within 2 weeks of receipt of the completed product list. No response within this period constitutes no objection to listed manufacturers or products but does not constitute a waiver of the requirement that products comply with Contract Documents. The Architect's response will include a list of unacceptable product selections, containing a brief explanation of reasons for this action.

1.5 QUALITY ASSURANCE

A. Source Limitations: To the fullest extent possible, provide products of the same kind from a single source.

1. When specified products are available only from sources that do not, or cannot, produce a quantity adequate to complete project requirements in a timely manner, consult with the Architect to determine the most important product qualities before proceeding. Qualities may include attributes, such as visual appearance, strength, durability, or compatibility. When a determination has been made, select products from sources producing products that possess these qualities, to the fullest extent possible.

B. Compatibility of Options: When the Contractor is given the option of selecting between 2 or more products for use on the Project, the product selected shall be compatible with products previously selected, even if previously selected products were also options.

1. Each prime contractor is responsible for providing products and construction methods that are compatible with products and construction methods of other prime or separate contractors.
2. If a dispute arises between prime contractors over concurrently selectable, but incompatible products, the Architect will determine which products shall be retained and which are incompatible and must be replaced.

C. Foreign Product Limitations: Except under one or more of the following conditions, provide domestic products, not foreign products, for inclusion in the Work:

1. No available domestic product complies with the Contract Documents.
2. Domestic products that comply with the Contract Documents are available only at prices or terms substantially higher than foreign products that comply with the Contract Documents.

D. Nameplates: Except for required labels and operating data, do not attach or imprint manufacturer's or producer's nameplates or trademarks on exposed surfaces of products that will be exposed to view in occupied spaces or on the exterior.

1. Labels: Locate required product labels and stamps on concealed surfaces or, where required for observation after installation, on accessible surfaces that are not conspicuous.
2. Equipment Nameplates: Provide a permanent nameplate on each item of service-connected or power-operated equipment. Locate on an easily accessible surface that is inconspicuous in occupied spaces. The nameplate shall contain the following information and other essential operating data:

a. Name of product and manufacturer.
b. Model and serial number.
c. Capacity.
d. Speed.
e. Ratings.

1.6 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle products according to the manufacturer's recommendations, using means and methods that will prevent damage, deterioration, and loss, including theft.

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

5. Store products at the site in a manner that will facilitate inspection and measurement of quantity or counting of units.
6. Store heavy materials away from the Project structure in a manner that will not endanger the supporting construction.
7. Store products subject to damage by the elements above ground, under cover in a weathertight enclosure, with ventilation adequate to prevent condensation. Maintain temperature and humidity within range required by manufacturer's instructions.

PART 2 - PRODUCTS

2.1 PRODUCT SELECTION

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

1. Provide products complete with accessories, trim, finish, safety guards, and other devices and details needed for a complete installation and the intended use and effect.
2. Standard Products: Where available, provide standard products of types that have been produced and used successfully in similar situations on other projects.

B. Product Selection Procedures: The Contract Documents and governing regulations govern product selection. Procedures governing product selection include the following:

1. Proprietary Specification Requirements: Where Specifications name only a single product or manufacturer, provide the product indicated. “Note that if a brand name is used an approved equal may be substituted. Instructions for “Requests for Substitutions” may be found in the General Conditions section. Substitutions must be approved by the Owner prior to award by the Local Council/Commission.”
2. Semi-proprietary Specification Requirements: Where Specifications name 2 or more products or manufacturers, provide 1 of the products indicated. No substitutions will be permitted.

    a. Where Specifications specify products or manufacturers by name, accompanied by the term "or equal" or "or approved equal," comply with the Contract Document provisions concerning "substitutions" to obtain approval for use of an unnamed product.

3. Nonproprietary Specifications: When Specifications list products or manufacturers that are available and may be incorporated in the Work, but do not restrict the Contractor to use of these products only, the Contractor may propose any available product that complies with Contract requirements. Comply with Contract Document provisions concerning "substitutions" to obtain approval for use of an unnamed product.
4. Descriptive Specification Requirements: Where Specifications describe a product or assembly, listing exact characteristics required, with or without use of a brand or trade name, provide a product or assembly that provides the characteristics and otherwise complies with Contract requirements.
5. Performance Specification Requirements: Where Specifications require compliance with performance requirements, provide products that comply with these requirements and are recommended by the manufacturer for the application indicated.

a. Manufacturer's recommendations may be contained in published product literature or by the manufacturer's certification of performance.

6. Compliance with Standards, Codes, and Regulations: Where Specifications only require compliance with an imposed code, standard, or regulation, select a product that complies with the standards, codes, or regulations specified.
7. Visual Matching: Where Specifications require matching an established Sample, the Architect's decision will be final on whether a proposed product matches satisfactorily.

a. Where no product available within the specified category matches satisfactorily and complies with other specified requirements, comply with provisions of the Contract Documents concerning "substitutions" for selection of a matching product in another product category.

8. Visual Selection: Where specified product requirements include the phrase "... as selected from manufacturer's standard colors, patterns, textures ..." or a similar phrase, select a product and manufacturer that complies with other specified requirements. The Architect will select the color, pattern, and texture from the product line selected.

PART 3 - EXECUTION

3.1 INSTALLATION OF PRODUCTS

A. Comply with manufacturer's instructions and recommendations for installation of products in the applications indicated. Anchor each product securely in place, accurately located and aligned with other Work.

1. Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for handling requests for substitutions made after award of the Contract.

B. Related Sections: The following Sections contain requirements that relate to this Section:
1. Division 1 Section "Reference Standards and Definitions" specifies the applicability of industry standards to products specified.
2. Division 1 Section "Submittals" specifies requirements for submitting the Contractor's Construction Schedule and the Submittal Schedule.

1.3 DEFINITIONS

A. Definitions in this Article do not change or modify the meaning of other terms used in the Contract Documents.

B. Substitutions: Changes in products, materials, equipment, and methods of construction required by the Contract Documents proposed by the Contractor after award of the Contract are considered to be requests for substitutions.

1.4 SUBMITTALS

A. Substitution Request Submittal: The Architect will consider requests for substitution if received within 30 days after commencement of the Work. Requests received more than 30 days after commencement of the Work may be considered or rejected at the discretion of the Architect.
1. Submit 3 copies of each request for substitution for consideration. Submit requests in the form and according to procedures required for change-order proposals.
2. Architect's Action: If necessary, the Architect will request additional information or documentation for evaluation within one week of receipt of a request for substitution. The Architect will notify the Contractor of acceptance or rejection of the substitution within 2 weeks of receipt of the request, or one week of receipt of additional information or documentation, whichever is later. Acceptance will be in the form of a change order.
   a. Use the product specified if the Architect cannot make a decision on the use of a proposed substitute within the time allocated.

PART 2 - PRODUCTS

2.1 SUBSTITUTIONS

A. Post Award Submittal Instructions For Substitutions: The Architect will receive and consider the Contractor's request for substitution when one or more of the following conditions are satisfied, as determined by the Architect. If the following conditions are not satisfied, the Architect will return the requests without action except to record noncompliance with these requirements.

1. Extensive revisions to the Contract Documents are not required.
2. Proposed changes are in keeping with the general intent of the Contract Documents.
3. The request is timely, fully documented, and properly submitted.
4. The specified product or method of construction cannot be provided within the Contract Time. The Architect will not consider the request if the product or method cannot be provided as a result of failure to pursue the Work promptly or coordinate activities properly.
5. The request is directly related to an "or-equal" clause or similar language in the Contract Documents.
6. The requested substitution offers the Owner a substantial advantage, in cost, time, energy conservation, or other considerations, after deducting additional responsibilities the Owner must assume. The Owner's additional responsibilities may include compensation to the Architect for redesign and evaluation services, increased cost of other construction by the Owner, and similar considerations.

B. The Contractor's submittal and the Architect's acceptance of Shop Drawings, Product Data, or Samples for construction activities not complying with the Contract Documents do not constitute an acceptable or valid request for substitution, nor do they constitute approval.

PART 3 - EXECUTION (Not Applicable)

END OF SECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes administrative and procedural requirements governing Owner Furnished Products

1. Multiple Prime Contracts: Provisions of this Section apply to the construction activities of each prime contractor.

B. Related Sections: The following Sections contain requirements that relate to this Section:

1. Division 1 Section "Product Requirements" General product requirements related to all products

1.3 DEFINITIONS

A. Owner: Defined in the Construction Agreement

1.4 RESPONSIBILITIES FOR OWNER FURNISHED PRODUCTS

A. Product Delivery: Product supplier will deliver products to jobsite for Contractor to receive on delivery date established by Contractor. Supplier will contact Contractor after Award of Contract to establish a product delivery and installation date, quantities of materials, and a coordination procedure.

B. Owner Responsibilities:

1. Responsibilities by Owner shall correspond to the party furnishing the product as specified hereinafter.
2. Arrange for delivery of supplier furnished shop drawings, product data, samples, and installation instructions to Contractor.
3. Arrange and pay for product delivery to site.
    a. Deliver supplier's shipment list of materials to Contractor.
    b. Submit claims for transportation damage.
    c. Arrange for replacement of damaged, defective, or missing items.
    d. Arrange for manufacturers' warranties, bonds, services, and inspections, as required.

C. Contractor Responsibilities:

1. Review supplier furnished shop drawings, product data, and samples under provisions of Section 01330. Submit to supplier with notification to Architect, Owner of any discrepancies or problems anticipated in the use the products.
2. Receive and unload products at the Site when specified.
3. Verify quantity of products furnished with shop drawings, Final Field Use Drawings, or Bills of Lading as applicable.
4. Promptly inspect products upon receipt for shortages, damaged, or defective items; report to Owner. Upon notification, Owner will arrange for delivery of replacement products.

5. Handle products at site, including uncrating, storage, and protection unless otherwise specified.
6. Install products when specified.
7. Provide for installation and hook-up at time of delivery of Owner installed equipment.
8. Protect installed products from damage.
9. Replace items damaged by Contractor.
10. Remove trash, debris, and rubbish.
11. Manufacturing Defects: Report suspected product manufacturing defects to Owner and Product Supplier. Upon notification, Owner will arrange for repair of product manufacturing defects.
    a. Deliver supplier's shipment list of materials to Contractor.
    b. Submit claims for transportation damage.
    c. Arrange for replacement of damaged, defective, or missing items.
    d. Arrange for manufacturers' warranties, bonds, services, and inspections, as required.

1.5 CONTRACTOR INSTALLATION OF OWNER FURNISHED PRODUCTS

A. Install in accordance with manufacturer's instructions.

B. Coordinate installation of Owner installed products and equipment.

C. Work in harmony with all subcontractors, suppliers and manufacturers.

D. Unpack and set in place, plumb, level, and secure.

E. Connect to mechanical, plumbing, and electrical systems as required.

F. Remove packaging and clean products.

G. Test and adjust as required.

PART 2 - PRODUCTS

NOT USED

PART 3 - EXECUTION

3.1 INSTALLATION OF PRODUCTS

A. Equipment will be furnished by the Owner for installation by the Contractor as specified in the Products Furnished by Others schedule included hereafter.

B. The Products Furnished by Others Schedule includes a listing of Owner furnished products as required in the listed specifications sections or drawings. Refer to the applicable drawings or individual sections for specific details regarding Owner furnished products therein. The Schedule provides summary information only and does not preclude or supersede requirements contained in the corresponding individual sections.

C. Unless otherwise specified, Contractor shall coordinate delivery date of Owner furnished equipment. Contractor shall coordinate lead times with Owner.

PRODUCTS FURNISHED BY OTHERS SCHEDULE

Specification Section	Description	Furnished By	Received By	Installed By	Delivery Date*
10513	Gear Lockers	Owner	Contractor	Contractor	Contractor to schedule
10513	Personal Lockers	Owner	Contractor	Contractor	Contractor to schedule
10513	Storage Lockers	Owner	Contractor	Contractor	Contractor to schedule
11451	Microwave	Owner	Contractor	Contractor	Contractor to schedule
11451	Coffee Maker	Owner	Contractor	Contractor	Contractor to schedule
11451	Residential Refrigerator	Owner	Contractor	Contractor	Contractor to schedule
11451	Residential Clothes Washer	Owner	Contractor	Contractor	Contractor to schedule
11451	Residential Clothes Dryer	Owner	Contractor	Contractor	Contractor to schedule
11451	Commercial Washer Extractor	Owner	Contractor	Contractor	Contractor to schedule
11451	Gear Drying Cabinet	Owner	Contractor	Contractor	Contractor to schedule
11451	Commercial Dishwasher and Accessories	Owner	Contractor	Contractor	Contractor to schedule
11451	Commercial Range	Owner	Contractor	Contractor	Contractor to schedule
11451	Char Broiler	Owner	Contractor	Contractor	Contractor to schedule
11451	Ice Maker	Owner	Contractor	Contractor	Contractor to schedule
11451	Equipment Stand (Char Broiler)	Owner	Contractor	Contractor	Contractor to schedule
11451	Prep Table	Owner	Contractor	Contractor	Contractor to schedule

END OF SCHEDULE

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

A. This Section includes administrative and procedural requirements for cutting and patching.

B. Related Sections: The following Sections contain requirements that relate to this Section:

1. Division 1 Section "Coordination" for procedures for coordinating cutting and patching with other construction activities.
2. Division 2 Section "Selective Structure Demolition" for demolition of selected portions of the building for alterations.
3. Refer to other Sections for specific requirements and limitations applicable to cutting and patching individual parts of the Work.

1.03 SUBMITTALS

A. Cutting and Patching Proposal: Submit a proposal describing procedures well in advance of the time cutting and patching will be performed if the Owner requires approval of these procedures before proceeding. Request approval to proceed. Include the following information, as applicable, in the proposal:

1. Describe the extent of cutting and patching required. Show how it will be performed and indicate why it cannot be avoided.
2. Describe anticipated results in terms of changes to existing construction. Include changes to structural elements and operating components as well as changes in the building's appearance and other significant visual elements.
3. List products to be used and firms or entities that will perform Work.
4. Indicate dates when cutting and patching will be performed.
5. Utilities: List utilities that cutting and patching procedures will disturb or affect. List utilities that will be relocated and those that will be temporarily out-of-service. Indicate how long service will be disrupted.
6. Where cutting and patching involves adding reinforcement to structural elements, submit details and engineering calculations showing integration of reinforcement with the original structure.
7. Approval by the Architect to proceed with cutting and patching does not waive the Architect's right to later require complete removal and replacement of unsatisfactory work.

1.04 QUALITY ASSURANCE

A. Requirements for Structural Work: Do not cut and patch structural elements in a manner that would change their load-carrying capacity or load-deflection ratio.

1. Obtain approval of the cutting and patching proposal before cutting and patching the following structural elements:

a. Bearing and retaining walls.
b. Structural concrete.
c. Structural steel.
d. Lintels.
e. Timber and primary wood framing.
f. Structural decking.
g. Miscellaneous structural metals.
h. Equipment supports.
i. Piping, ductwork, vessels, and equipment.

B. Operational Limitations: Do not cut and patch operating elements or related components in a manner that would result in reducing their capacity to perform as intended. Do not cut and patch operating elements or related components in a manner that would result in increased maintenance or decreased operational life or safety.

1. Obtain approval of the cutting and patching proposal before cutting and patching the following operating elements or safety related systems:

a. Primary operational systems and equipment.
b. Air or smoke barriers.
c. Water, moisture, or vapor barriers.
d. Membranes and flashings.
e. Fire protection systems.
f. Noise and vibration control elements and systems.
g. Control systems.
h. Electrical wiring systems.

C. Visual Requirements: Do not cut and patch construction exposed on the exterior or in occupied spaces in a manner that would, in the Architect's opinion, reduce the building's aesthetic qualities. Do not cut and patch construction in a manner that would result in visual evidence of cutting and patching. Remove and replace construction cut and patched in a visually unsatisfactory manner.

1. If possible retain the original Installer or fabricator to cut and patch the exposed Work listed below. If it is impossible to engage the original Installer or fabricator, engage another recognized experienced and specialized firm.

PART 2 – PRODUCTS – NOT USED

PART 3 - EXECUTION

3.01 INSPECTION

A. Examine surfaces to be cut and patched and conditions under which cutting and patching is to be performed before cutting. If unsafe or unsatisfactory conditions are encountered, take corrective action before proceeding.

1. Before proceeding, meet at the 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.

3.02 PREPARATION

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

B. Protection: Protect existing construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of the Project that might be exposed during cutting and patching operations.

C. Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.

D. Avoid cutting existing pipe, conduit, or ductwork serving the building but scheduled to be removed or relocated (if necessary) until provisions have been made to bypass them.

3.03 PERFORMANCE

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

1. Cutting: Cut existing construction using methods least likely to damage elements retained or adjoining construction.

2. In general, where cutting, use hand or small power tools designed for sawing or grinding, not hammering and chopping. Cut holes and slots as small as possible, neatly to size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
3. To avoid marring existing finished surfaces, cut or drill from the exposed or finished side into concealed surfaces.
4. Cut through concrete using a cutting machine, such as a Carborundum saw or a diamond-core drill.
5. Comply with requirements of applicable Division 2 Sections where cutting and patching requires excavating and backfilling.

6. Where services are required to be removed, relocated, or abandoned, by-pass utility services, such as pipe or conduit, before cutting. Cut-off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal the remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after by-passing and cutting.

B. Patching: Patch with durable seams that are as invisible as possible. Comply with specified tolerances.

1. Where feasible, inspect and test patched areas to demonstrate integrity of the installation.

C. Warranty: Manufacturers' Watertight Roofing System

1. Contractor's responsibility to maintain Johns Manville PVC Membrane 5" ENERGY 3 Polyisocyanurate Insulation existing roofing material 15 yr warranty at all times during the cutting/patching process.
2. Copy of warranty included in this section for reference.

3.04 CLEANING

A. Clean areas and spaces where cutting and patching are performed. Completely remove paint, mortar, oils, putty, and similar items. Thoroughly clean piping, conduit, and similar features before applying paint or other finishing materials. Restore damaged pipe covering to its original condition.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Cleaning and maintenance of site premises.

1.2 REGULATORY REQUIREMENTS

A. Codes and Standards: Comply with applicable Federal, State and Local codes and regulations relative to environmental safety regulations.

B. Hazards Controls: Store volatile waste in covered metal containers and remove from premises daily. Prevent accumulation of wastes which create hazardous conditions.

C. Pollution Control:
   1. Do not burn or bury rubbish and waste materials on the project site.
   2. Do not disposal of volatile fluid wastes (such as mineral spirits, oil or paint thinner) in storm or sanitary sewer systems or into streams or waterways.
   3. Do not disposal of any toxic chemicals in storm or sanitary sewer systems. Comply with EPA requirements regarding disposal.

PART 2 - PRODUCTS

2.1 CLEANING MATERIALS

A. Use only cleaning materials recommended by manufacturer of surface to be cleaned.

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

C. Cleaning materials shall be clearly labeled and safely stored when not in use. Maintain control of cleaning materials while in use. Do not leave unattended. No flammable materials or liquids may be stored in the existing building or in the new addition.

PART 3 - EXECUTION

3.1 CLEANING REQUIREMENTS

A. Oversee cleaning and ensure that building and grounds are maintained free from accumulations of waste materials and rubbish.

B. In exterior work, sprinkle dusty debris with fine water mist to control accumulation of dust. Avoid puddling.

C. Vacuum clean interior building areas when ready to receive finish painting and continue vacuum cleaning on an as-needed basis until building is ready for acceptance or occupancy.

D. Schedule cleaning operations so that dust and other contaminants resulting from cleaning process will not fall on wet, newly-painted surfaces.

E. Clean exterior premises daily. Do not let debris enter customer areas.

3.2 TRASH REMOVAL

A. On a daily basis, clean work areas and access, and dispose of waste materials, rubbish and debris.

B. Do not allow waste materials, rubbish and debris to accumulate and become an unsightly or hazardous condition.

C. Keep streets and access to site free of rubbish and debris.

3.3 FINAL CLEANING

A. Execute final cleaning prior to final inspection as follows:
1. 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.
2. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
3. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.
4. Remove tools, construction equipment, machinery, and surplus material from Project site.
5. 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.
6. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
7. Clean debris from roofs, gutters, downspouts, and drainage systems.
8. Vacuum carpet and similar soft surfaces, removing debris and excess nap; shampoo if visible soil or stains remain.
9. Vacuum clean all interior floor surfaces.
10. 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.
11. Remove labels that are not permanent.
12. 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.
13. Wipe surfaces of mechanical and electrical equipment and similar equipment. Remove excess lubrication, paint, and mortar droppings, and other foreign substances.
14. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
15. Replace disposable air filters and clean permanent air filters of equipment operated during construction. Clean exposed surfaces of diffusers, registers, and grills.
16. Clean ducts, blowers, and coils if units were operated without filters during construction.
17. 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.
18. Leave Project clean and ready for occupancy.

B. Cleaning of Toilets Prior to Possession:
1. Immediately prior to possession, clean toilets thoroughly including each toilet fixture and accessory.
2. Clean entire wall and floor surfaces using cleaning solutions and wipe dry to prevent surface film or residue.
3. Clean water closets and sinks with scrubbing cleansers to remove stains and deposits.
4. Clean and polish stainless steel accessories and toilet partitions to a spotless luster using soap, ammonia, or mild detergent and water. Apply with sponge or soft cloth, rinse with

clear water, and wipe dry. As an alternate, use a commercial stainless steel cleaner and polish.

5. Clean mirror surfaces using glass cleaner.

C. Employ skilled workmen for final cleaning.

D. Prior to final completion or Owner possession, conduct an inspection of sight-exposed interior and exterior surfaces and all work areas with the Owner's Program Manager or Representative to verify that entire Work is clean.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for warranties required by the Contract Documents, including manufacturer's standard warranties on products and special warranties.

1. Refer to the General Conditions for terms of the Contractor's period for correction of the Work.

B. Related Sections: The following Sections contain requirements that relate to this Section:

1. Division 1 Section "Submittals" specifies procedures for submitting warranties.
2. Division 1 Section "Project Closeout" specifies contract closeout procedures.
3. Divisions 2 through 16 Sections for specific requirements for warranties on products and installations specified to be warranted.
4. Certifications and other commitments and agreements for continuing services to Owner are specified elsewhere in the Contract Documents.

C. Disclaimers and Limitations: Manufacturer's disclaimers and limitations on product warranties do not relieve the Contractor of the warranty on the Work that incorporates the products. Manufacturer's disclaimers and limitations on product warranties do not relieve suppliers, manufacturers, and subcontractors required to countersign special warranties with the Contractor.

D. Separate Prime Contracts: Each prime contractor is responsible for warranties related to its own contract.

1.3 DEFINITIONS

A. Standard product warranties are preprinted written warranties published by individual manufacturers for particular products and are specifically endorsed by the manufacturer to the Owner.

B. Special warranties are written warranties required by or incorporated in the Contract Documents, either to extend time limits provided by standard warranties or to provide greater rights for the Owner.

1.4 WARRANTY REQUIREMENTS

A. Related Damages and Losses: When correcting failed or damaged warranted construction, remove and replace construction that has been damaged as a result of such failure or must be removed and replaced to provide access for correction of warranted construction.

B. Reinstatement of Warranty: When Work covered by a warranty has failed and been corrected by replacement or rebuilding, reinstate the warranty by written endorsement. The reinstated warranty shall be equal to the original warranty with an equitable adjustment for depreciation.

C. Replacement Cost: Upon determination that Work covered by a warranty has failed, replace or rebuild the Work to an acceptable condition complying with requirements of the Contract Documents. The Contractor is responsible for the cost of replacing or rebuilding defective Work regardless of whether the Owner has benefited from use of the Work through a portion of its anticipated useful service life.

D. Owner's Recourse: Expressed warranties made to the Owner are in addition to implied warranties and shall not limit the duties, obligations, rights, and remedies otherwise available under the law. Expressed warranty periods shall not be interpreted as limitations on the time in which the Owner can enforce such other duties, obligations, rights, or remedies.

1. Rejection of Warranties: The Owner reserves the right to reject warranties and to limit selection to products with warranties not in conflict with requirements of the Contract Documents.

E. Where the Contract Documents require a special warranty, or similar commitment on the Work or part of the Work, the Owner reserves the right to refuse to accept the Work, until the Contractor presents evidence that entities required to countersign such commitments are willing to do so.

1.5 SUBMITTALS

A. Submit written warranties to the Architect prior to the date certified for Substantial Completion. If the Architect's Certificate of Substantial Completion designates a commencement date for warranties other than the date of Substantial Completion for the Work, or a designated portion of the Work, submit written warranties upon request of the Architect.

1. When a designated portion of the Work is completed and occupied or used by the Owner, by separate agreement with the Contractor during the construction period, submit properly executed warranties to the Architect within 15 days of completion of that designated portion of the Work.

B. When the Contract Documents require the Contractor, or the Contractor and a subcontractor, supplier or manufacturer to execute a special warranty, prepare a written document that contains appropriate terms and identification, ready for execution by the required parties. Submit a draft to the Owner, through the Architect, for approval prior to final execution.

C. Forms for special warranties are included at the end of this Section. Prepare a written document utilizing the appropriate form, ready for execution by the Contractor, or by the Contractor, subcontractor, supplier, or manufacturer. Submit a draft to the Owner, through the Architect, for approval prior to final execution.

1. Refer to individual specification sections and Construction Drawings for specific content requirements and particular requirements for submitting special warranties.

D. Form of Submittal: At Final Completion compile 2 copies of each required warranty properly executed by the Contractor, or by the Contractor, subcontractor, supplier, or manufacturer. Organize the warranty documents into an orderly sequence based on the table of contents of the Project Manual.

E. Bind warranties and bonds in heavy-duty, commercial-quality, durable 3-ring, vinyl-covered loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch (115-by-280-mm) paper.

1. Provide heavy paper dividers with celluloid covered tabs for each separate warranty. Mark the 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 the Installer.
2. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project title or name, and name of the Contractor.
3. When warranted construction requires operation and maintenance manuals, provide additional copies of each required warranty, as necessary, for inclusion in each required manual.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 LIST OF WARRANTIES

A. Schedule: ***Provide warranties on Products and Installations for all elements of work included in the scope of this project.***

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY:

A. Related Documents:
1. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division-1 Specification Sections, apply to work of this Section.

B. Section Includes
1. Descriptions of Requirements.
2. Closeout Procedures.
3. Final Closeout Submittals.
4. Project Record Documents.
5. Operations and Maintenance Data.
6. Warranties and Bonds.

1.2 DESCRIPTION OF REQUIREMENTS:

A. Definitions:
1. Project closeout is the term used to describe certain collective project requirements, indicating completion of the work that are to be fulfilled near the end of the Contract time in preparation for final acceptance and occupancy of the work by the Owner, as well as final payment to the Contractor and the normal termination of the Contract.

2. Substantial Completion shall be the term as defined by the Contract, including General and Supplemental Conditions.

3. Final Completion shall be the term as defined by the Contract, including General and Supplemental Conditions.

B. Time of closeout is directly related to “Substantial Completion”; therefore, the time of closeout may be either a single time period for the entire work or a series of time periods for individual elements of the work (phases) that have been certified as substantially complete at different dates. This time variation, if any, shall be applicable to the other provisions of this section.

1.3 CLOSEOUT PROCEDURES:

A. General: Comply with closeout submittal requirements defined within individual Sections. Submittal procedures described herein shall apply unless described in individual Sections.

B. Compete all work covered in the Contract Documents before requesting the Architect/Engineer’s inspection for certification of substantial completion, either for the entire work or for portions of the work.

C. When Contractor considers Work to be Substantially Complete, submit written certification to Owner's Representative and Architect as follows:
   1. Contract Documents have been reviewed.
   2. Work has been inspected.
   3. Work is complete in accordance with Contract Documents.
   4. Work is ready for inspection.
   5. Request the Architect/Engineer's inspection for certification of substantial completion. Provide a punch list of known exceptions (a comprehensive list of items to be completed or corrected prior to final payment) in the request.

D. Substantial Completion Inspection: Upon receipt of Contractors written certification and request for the Architect/Engineer's inspection for certification of substantial completion, the Architect/Engineer shall make an inspection to determine whether or not the Work is substantially complete.
   1. If Architect's inspection discloses any item which is not sufficiently complete in accordance with the Contract Documents:
      a. A certificate of Substantial completion will not be issued.
      b. The Architect will provide the Contractor a list of items that shall be completed or corrected in order to achieve Substantial Completion.
      c. The Contractor shall promptly complete or correct all items indicated in order to achieve Substantial Completion.
      d. Contractor shall provide to Architect documented evidence of items completed in the format acceptable to Architect.
   2. When Work is substantially complete, the Architect will prepare and submit the Certificate of Substantial Completion in accordance with the Contract.

E. In the progress payment following the date substantial completion complete the administrative actions and submittals indicated in Section 01250 for Application for payment at Substantial Completion.
   1. Include supporting documentation for completion as indicated in these contract documents.
   2. Submit a statement showing an accounting of changes to the Contract Sum.
   3. Advise Owner of pending insurance changeover requirements.
   4. Submit specific warranties, workmanship/maintenance bonds, maintenance agreements, final certifications and similar documents, and test and balance reports
   5. Obtain and submit releases enabling the Owner's full, unrestricted use of the work and access to services and utilities. Where required, include occupancy permits, operating certificates, and similar releases.
   6. Deliver extra stock of material and similar physical items to the Owner.

7. Make the final changeover of locks and transmit the keys to the Owner. Advise the Owner's personnel of the changeover in security provisions.

8. Complete start-up testing of systems, and instruction of the Owner's operating and maintenance personnel. Discontinue or change over and remove temporary facilities and services from the project site, along with construction tools and facilities, mockups, and similar elements.

9. Complete final cleaning up requirements, including touch-up painting of marred surfaces.

10. Touch-up and otherwise repair and restore marred exposed finishes.

11. Inspection Procedures: See General and Supplementary Conditions.

F. Final Inspection: Upon receipt of Contractors written notice that Work, including punch list items resulting from earlier inspection, has been completed and is ready for final inspection and acceptance and having received the final Application for payment, the Architect will make an inspection. When the Architect finds the Work acceptable under the Contract Documents and the Contract fully performed, the Architect will issue the Final Certificate of Payment.

G. Reinspection Procedures: The Architect/Engineer will reinspect the Work upon receipt of the Contractor's notice that the Work, including punch-list items resulting from earlier inspection, has been completed, except for these items whose completion has been delayed because of circumstances that are acceptable to the Architect/Engineer.
1. Upon completion of reinspection, the Architect/Engineer will either recommend of final acceptance to the Owner, advise the Contractor of Work that is incomplete or of obligations that have not been fulfilled, but are required for final acceptance.
2. If necessary, the reinspection procedure will be repeated. All reinspections by the Architect/Engineer from this point are considered additional services, and shall be performed at the expense of the Contractor.

1.4 FINAL CLOSEOUT SUBMITTALS:

A. General Closeout Submittals: Complete the following before requesting the Architect/Engineer's final inspection for recommendation of final acceptance and final payment as required by the General Conditions. List known exceptions, if any, in the request.

B. Specific Closeout Submittals: Closeout submittals are submittals specified in the individual sections as "Closeout" and shall not be otherwise considered a closeout document regardless of the type of submittal. Submittals not classified as a closeout submittal shall be considered a regular submittal under the provisions of Section 01330. For example: Maintenance Data may, or may not, be classified as a closeout unless specifically identified as a closeout in the individual section Part 1 SUBMITTAL paragraph.

C. Unless otherwise specified in the individual sections, submit closeout submittals to the Owner within 90 days after Substantial Completion of the Work.

D. All closeout documents specified in the individual sections shall be submitted. Specific documents listed below shall be included separately in hard copy format and an Electronic Closeout Document Submission as specified hereinafter.

E. Final closeout submittals shall be received and approved by Owner before final application for payment will be approved.

1. Submit the final payment request with final releases and supporting documentation not previously submitted and accepted. Include certificates of insurance for products and completed operations where required.

2. Submit a certified copy of the Architect/Engineer's final punch-list of itemized work to be completed or corrected, stating that each item has been completed or otherwise resolved for acceptance.

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3. Submit final meter readings for utilities, a measured record of stored fuel, and similar data either as of the date of Substantial Completion, or else when the Owner took possession of and responsibility for corresponding elements of the Work.

4. Submit consent of surety to final payment, AIA Document G707, (4 copies with original signatures).

5. Submit a final liquidated damages settlement statement, acceptable to the Owner.

6. Submit Statutory Affidavit (4 copies with original signatures).

7. Submit evidence of final, continuing insurance coverage complying with insurance requirements.

8. Submit Certificate and Release (4 copies with original signatures).

1.5 ELECTRONIC CLOSEOUT DOCUMENT SUBMISSION:

A. Submit 2 sets of CD's of all documents provided in closeout submittal package.

B. If Contractor fails to provide a fully completed Electronic Closeout Document Submission within 90 days after Substantial Completion of the Work, then Contractor agrees to pay Owner the sum of $250.00 per day, as liquidated damages and not as a penalty, until the fully completed Electronic Closeout Document Submission is received and approved by Architect.

C. Architect's/Engineer's review of the closeout submittal package shall be limited to (2) two reviews as part of basic services. Additional reviews shall be performed at the expense of the Contractor.

1.6 PROJECT RECORD DOCUMENTS:

A. General: Specific requirements for record documents are indicated in the individual sections of these specifications. Other requirements are indicated in the General and Supplementary Conditions. General submittal requirements are indicated in the various "submittals" sections.

1. Do not use record documents for construction purposes; protect from deterioration and loss in a secure, fire-resistive location; provide access to record documents for the Architect's and Clerk-of-the-Work's reference during normal working hours.

B. Maintain on site one set of the following record documents. Record actual revisions to the Work.
1. Contract Drawings.
2. Specifications
3. Addenda
4. Change Orders and other Modifications to the Contract.
5. Reviewed shop drawings, product data, and samples.

C. Maintain Record Documents separate from documents used for construction.

D. As-built Record Documents and Shop Drawings: Record as-builts shall be maintained and submitted for the primary purpose of recording the locations for concealed interior and exterior underground utilities as specified in the individual specifications. Legibly record actual measured horizontal and vertical locations of interior and exterior underground utilities and appurtenances, referenced to permanent surface improvements. Mark up the set of record documents to show the actual installation where the installation work varies substantially from the Work as originally shown. Mark whichever drawing is most capable of showing the actual "field" condition fully and accurately; however, where Shop Drawings are used for markup, record a cross-reference at the corresponding location on the working drawings. Give particular attention to concealed work that would be difficult to measure and record at a later date

1. Mark record sets with red erasable pencil and, where feasible, use other colors to distinguish between variations in separate categories of the work.

2. Mark-up new information which is known to be important to the Owner, but for some reason was not shown on either Contract Drawings or Shop Drawings.

3. Note related change-order numbers where applicable.

4. Organize record drawing sheets into manageable sets, bind with durable-paper cover sheets; and print suitable titles, dates, and other identification on the cover of each set.

E. Record required as-built information concurrent with construction progress. Do not permanently conceal work until required information has been recorded.

F. At Project completion, the Contractor shall place one set the Record Documents (including Building and Civil Record Drawings, Specifications, Addenda, and Change Orders) enclosed in a plastic pipe tube (fixed cap at one end and a threaded-cap on the other end) for storage in the Electrical Room.

1.7 OPERATION AND MAINTENANCE DATA:

A. Manuals: Organize operating and maintenance data into at least three (3) suitable sets of manageable size. Bind data into individual binders, properly identified and indexed. Bind each set of data in heavy-duty, 2-inch, 3-ring, vinyl-covered binders, with pocket folders for folded sheet information. Mark appropriate identification on both front and spine of each binder.

B. Include the following types of information in operation and maintenance manuals:
1. Emergency instructions.
2. Spare parts list.
3. Copies of warranties.
4. Wiring diagrams.
5. Recommended "turn-around" cycles.
6. Inspection procedures.
7. Shop Drawings and Product Data.
8. Additional requirements specified in Mechanical and Electrical Divisions.

1.8 WARRANTIES AND BONDS:

A. Submit required warranties and bonds
1. Assemble documents from Subcontractors, suppliers, and manufacturers.
2. For equipment put into use with Owner's acceptance during construction, submit within ten days after first operation, listing date of acceptance as start of warranty period.
3. For items of Work delayed materially beyond Date of Substantial Completion, provide updated submittal within ten days after acceptance, listing date of acceptance as start of warranty period.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 CLOSEOUT TRAINING, DEMONSTRATION, AND INSTRUCTIONS:

A. General Operation and Maintenance Instructions: Arrange for each Installer of operating equipment and other work that requires regular or continuing maintenance, to meet at the site with the Owner's personnel and Clerk-of-the-works to provide necessary basic instruction in proper operation and maintenance of the entire work. Where installers are not experienced in the required procedures, include instruction by the manufacturer’s representatives.

1. As part of this instruction, provide a detailed review of the following items:

a) Maintenance manuals.
b) Record documents.
c) Spare parts and materials.
d) Identification systems.
e) Control sequences.
f) Hazards.
g) Cleaning.
h) Warranties and bonds maintenance agreements and similar continuing commitments.

B. As part of this instruction for operating equipment, demonstrate the following procedures:

1. Startup.
2. Shutdown.
3. Emergency operations.
4. Noise and vibration adjustments.
5. Safety procedures.
6. Economy and efficiency adjustments.
7. Effective energy utilization.

3.2 FINAL CLEANING:

A. General: Special cleaning requirements for specific units of work are included in the appropriate sections of the other Divisions of the Specifications. General cleaning during the regular progress of the work is required by the General Conditions and is also included under Section 01500 – TEMPORARY FACILITIES AND CONTROLS.

B. Cleaning: Provide final cleaning of the work at the time indicated. Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit of work to the condition expected from a normal, commercial building cleaning and maintenance program. Comply with manufacturer's instructions for operations.

1. Complete the following cleaning operations before requesting the Architect/Engineer’s inspection for final acceptance or certification of Substantial Completion.

2. Remove labels which are not required as permanent labels.

3. Clean transparent materials, including mirrors and glass in doors and windows, to a polished condition. Remove putty and other substances which are noticeable as vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials.

4. Clean exposed exterior and interior hard-surfaced finishes to a condition that is free of dust, stains, films, and similar noticeable distracting substances. Restore reflective surfaces to their original reflective condition. Leave concrete floors broom clean. Vacuum carpeted surfaces.

5. Wipe surfaces of mechanical and electrical equipment clean. Remove excess lubrication and other substances. Clean plumbing fixtures to a sanitary condition. Clean light fixtures and lamps.

6. Clean the project site, including landscape development areas, of rubbish, litter, and other foreign substances. Sweep paved areas to a broom clean condition; remove stains, spills, and other foreign deposits. Rake grounds that are neither paved nor planted, to a smooth even-textured surface.

C. Removal of Protection: Except as otherwise indicated or requested by the Architect/Engineer, remove temporary protection devices and facilities which were installed during the course of the work to protect previously completed work during the remainder of the construction period.

D. Compliance: Comply with safety standards and governing regulations for cleaning operations. Do not burn waste materials at the site. Do not bury debris or excess materials on the Owner's property. Do not discharge volatile or other harmful or dangerous materials into drainage system. Remove waste materials from the site and dispose of in a lawful manner.

1. Where extra materials of value remaining after completion of associated work have become the Owner's property, dispose of these materials to the Owner’s best advantage as directed.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY:

A. Work covered in this section includes:
1. Requirements for electronic submittal of Warranties, Project Records and Project Related Data.
2. Contractor Warranty Form
3. Subcontractor or Installer Warranty Form
4. Contractor Self Performing Trade Work or Installation Warranty Form
5. Contractor Affidavit Certifying that Specific Requested Documentation is Not Applicable
6. Contractor Exit Affidavit

B. Related Sections
1. Section 01770 Project Closeout.
2. Section 01740 Warranties.

1.2 DESCRIPTION OF REQUIREMENTS:

A. General: Where the Contract Documents require submittals as directed by the Owner, Architect or other Owner's Representative, those items shall be submitted as otherwise directed. This section refers to data required from the Contractor to populate the Owner's electronic project database and provides instructions for the collection of select project documents and data in electronic form. Those select items are listed below in this Section. Items listed in this Section may be the same, similar or related to items requested by others or as otherwise indicated in the Contract documents. The Contractor may request of others collecting documentation on behalf of the Owner, if items required by this Section will suffice in whole or in part as substitution for items otherwise requested. Items of this Section shall be provided as directed in this Section. Waiver or substitution of items required by this Section is not allowed.

1.3 ELECTRONIC FORMS:

A. General: Upon access to the Owner's Database, Contractor shall be asked to complete electronic forms. Follow instructions to complete required electronic forms. Applicable electronic data forms from the following list shall be completed by Contractor. List is subject to change.
1. Contractor Information.
2. General Project Information
3. Project Details
4. Area of Work
5. Contract Documents
6. Permits

7. Photos

8. Subcontractors of Installers

9. Product Information

10. GC and Installer Warranties

11. Change Orders and Other Contract Documents

12. As-builts

13. Test

14. Closeout Dates

1.4 ELECTRONIC SUBMITTALS:

A. The following minimum documents shall be electronically provided by Contractor into the electronic database.

1. All required permits (Building Permit, Site Development Permit, Mechanical Permit, Electrical Permit, Plumbing Permit, Right-of-Way Permit, Fire Systems Permit, any other permits obtained in the performance of the Project).

2. Fully Executed Contract Documents complete with all attachments (Contract, General Conditions, Supplementary Conditions, Contract Drawings, Contract Specifications, Addenda, Fully Executed Change Orders and Change Directives, all other documents that constitute amendments to Contract).

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3. As-built Plans.

4. All test reports (Test & Balance, Concrete, all other test reports).

5. Certificate of Completion or Certificate of Occupancy.

6. Sub-Contractor and Installer list complete with Company Name, Contact Person, Address, email, phone and fax.

7. Substantial Completion form, fully executed.

8. Final Completion form, fully executed.

9. Project Photos

10. Product Data

11. Operation and Maintenance documents, submitted as separate electronic file per item

12. Manufacturer Warranties, fully executed, project specific, submitted as separate electronic file per item

13. Tests

14. Contractor Warranty Form, fully executed

15. Subcontractor of Installer Warranty forms, fully executed, submitted as separate electronic file per item

16. Contractor Self Performing Trade Work or Installation Warranty Form.

17. Manufacturer Warranties, fully executed, project specific, submitted as separate electronic file per item.

18. Contractor Affidavit Certifying that Requested Documentation is Not Applicable, per document where applicable, fully executed.

19. Contractor Exit Affidavit, fully executed.

20. Competed Electronic Forms provided in the database.

B. Format: Uploaded documents shall be provided in *.pdf format, with the exception of photos. Photos shall be submitted as *jpg.

C. Size: *.pdf shall be no larger than size indicated by the system instructions. *.jpg shall be no larger than size indicated by the system instructions.

D. Final Naming: File names shall representative of the document therein. File names shall be no longer than fifteen (15) characters. Other file naming instructions may be applicable as indicated in the database.

PART 2 - PRODUCTS (Not Applicable)

PART 3 – EXECUTION (Not Applicable)

END OF SECTION

CONTRACTOR WARRANTY FORM

PROJECT:

LOCATION:

OWNER:

I/We, (Company under Contract with Owner) , Contractor for the above referenced project, do hereby warrant that all labor and work performed are in accord with Contract Documents and are of professional quality and all materials and equipment furnished are of good quality and new unless otherwise allowed in the Contract Documents. Contractor warrants all will be free from defects due to defective materials or workmanship for a period of one year from Date of Substantial Completion or other Date of Acceptance as approved by the Owner. Contractor further warrants that workmanship or installation shall not result in void of warranty by any manufacturer of products or equipment installed. Such additional guarantee by the Contractor regarding manufacturer's warranties shall survive for the full term of the manufacturer's warranty, which may be beyond the one year indicated in the standard Contractor warranty period.

This warranty commences on (Date Accepted by Owner) . The warranty expires on midnight (One year from Date Accepted by Owner) , EXCEPT where any work of Contractor results in void of manufacturer's warranty. The Contractor shall additionally warrant the work to a period consistent with the warranty term of the applicable manufacturer's warranty in the case where Contractor's work under the contract is found to have caused a manufacturer's warranty to be voided.

Should any defect develop during the warranty period due to improper materials, workmanship or arrangement, the same, including adjacent work displaced, shall be made good by the undersigned at no expense to the Owner.

The Owner will give Contractor written notice of defective work. Where the Contractor fails to correct defective work within 30 days after receiving written notice, the Owner may, if he chooses, correct defects and charge Contractor costs for such correction. Contractor agrees to pay such charges upon demand from the Owner.

Nothing in the above shall be deemed to apply to work which has been abused, neglected or otherwise misused or unmaintained by the Owner, representatives of the Owner or others.

Guarantor: _____
(Contractor under contract with Owner)

By:_____
(Print Name)

Title: _____
(Print Title)

Signature: _____
(Above Named indicates he/she is an authorized representative of Guarantor):

Notary Public: _____

My Commission Expires _____

This _____ day of _____, 20___.

END OF FORM

SUBCONTRACTOR OR INSTALLER WARRANTY FORM

PROJECT:

LOCATION:

OWNER:

I/We, {Company Name}, Subcontractor to (Company Name of General Contractor) for (List one trade only. Use additional sheets for more trades); as described in Specification Section(s) (List Appropriate Sections of Specifications, as applicable) do hereby warrant that all labor and work performed are in accord with Contract Documents and are of professional quality and all materials and equipment furnished are of good quality and new unless otherwise allowed in the Contract Documents. Sub-contractor warrants all will be free from defects due to defective materials or workmanship for a period of year(s) from Date of Substantial Completion or other Date of Acceptance as approved by the Owner. Sub-contractor further warrants that workmanship or installation shall not result in void of warranty by any manufacturer of products or equipment installed. Such additional guarantee by the Sub-contractor regarding manufacturer's warranties shall survive for the full term of the manufacturer's warranty, which may be beyond the year(s) indicated in the standard Sub-contractor warranty period indicated above.

This warranty commences on (Date Accepted by Owner). The warranty expires on midnight ( ) year(s) from Date Accepted by Owner, EXCEPT where any work of sub-contractor results in void of manufacturer's warranty. The Sub-contractor shall additionally warrant the work to a period consistent with the warranty term of the applicable manufacturer's warranty in the case where Sub-contractor's work is found to have caused a manufacturer's warranty to be voided.

Should any defect develop during the warranty period due to improper materials, workmanship or arrangement, the same, including adjacent work displaced, shall be made good by the undersigned at no expense to the Owner. The Owner will give Sub-contractor written notice of defective work. Where the Sub-contractor fails to correct defective work within 30 days after receiving written notice, the Owner may, if he chooses, correct defects and charge sub-contractor costs for such correction. Contractor and Subcontractor individually and collectively agree to pay such charges upon demand from the Owner.
Nothing in the above shall be deemed to apply to work which has been abused, neglected or otherwise misused or unmaintained by the Owner, representatives of the Owner or others.

Guarantor: _____ **Guarantor:** _____
(Subcontractor or Installer) **(General Contractor)**
By:_____ **By:**_____
(Print Name) **(Print Name)**

Title: _____ **Title:** _____
(Print Title) **(Print Title)**
Signature: _____ **Signature:** _____
(Above Named Signatories indicate he/she are authorized representative of Respective Guarantors)

Notary Public: _____

My Commission Expires _____

This _____ day of _____, 20___.

END OF FORM

CONTRACTOR SELF PERFORMING TRADE WORK OR INSTALLATION WARRANTY FORM

PROJECT:

LOCATION:

OWNER:

I/We, (General Contractor Company Name) , have SELF PERFORMED the specific trade work and/or Installation for (List ONE trade only. Use additional sheets for more trades) ; as described in Specification Section(s) (List Appropriate Sections of Specifications, as applicable) do hereby warrant that all labor and work performed are in accord with Contract Documents and are of professional quality and all materials and equipment furnished are of good quality and new unless otherwise allowed in the Contract Documents. Sub-contractor warrants all will be free from defects due to defective materials or workmanship for a period of year(s) from Date of Substantial Completion or other Date of Acceptance as approved by the Owner. Contractor further warrants that workmanship or installation shall not result in void of warranty by any manufacturer of products or equipment installed. Such additional guarantee by the Contractor regarding manufacturer's warranties shall survive for the full term of the manufacturer's warranty, which may be beyond the year(s) indicated in the standard Sub-contractor warranty period indicated above.

This warranty commences on (Date Accepted by Owner) . The warranty expires on midnight ( ) year(s) from Date Accepted by Owner , EXCEPT where any work of Contractor results in void of manufacturer's warranty. The Contractor shall additionally warrant the work to a period consistent with the warranty term of the applicable manufacturer's warranty in the case where Sub-contractor's work under is found to have caused a manufacturer's warranty to be voided.

Should any defect develop during the warranty period due to improper materials, workmanship or arrangement, the same, including adjacent work displaced, shall be made good by the undersigned at no expense to the Owner. The Owner will give Contractor written notice of defective work. Where the Contractor fails to correct defective work within 30 days after receiving written notice, the Owner may, if he chooses, correct defects and charge Contractor costs for such correction. Contractor agrees to pay such charges upon demand from the Owner.

Nothing in the above shall be deemed to apply to work which has been abused, neglected or otherwise misused or unmaintained by the Owner, representatives of the Owner or others.

Guarantor: _____
(Contractor)
By:_____
(Print Name)

Title: _____
(Print Title)
Signature: _____
(Above Named Signatory indicates he/she is the authorized representative of Guarantor)

Notary Public: _____

My Commission Expires _____
This _____ day of _____, 20___.

END OF FORM

CONTRACTOR AFFIDAVIT CERTIFYING THAT REQUESTED SPECIFIC DOCUMENTATION IS NOT APPLICABLE

PROJECT:

LOCATION:

OWNER:

I/We, _____ (Contractor Company Name) , Contractor for the above referenced project, do hereby warrant that , _____ (Title of Specific Document or Item, Enter ONE document or Item per Affidavit. Use additional sheets if other documents or items apply) was requested by the data collection system is Not Applicable to the Project indicated above. The specific document or item requested is Not Applicable because

_____

_____

(Enter all relevant details as to why the above named document or item is not applicable).

Affiant: _____
(Contractor)

By:_____
(Print Name)

Title: _____
(Print Title)

Signature: _____
(Above Named Signatory indicates he/she is the authorized representative of Guarantor)

Notary Public: _____

My Commission Expires _____
This _____ day of _____, 20___.

END OF DOCUMENT

CONTRACTOR EXIT AFFIDAVIT

PROJECT:

LOCATION:

OWNER:

I/We,_____(Contractor Company Name) , Contractor for the above referenced project, do hereby warrant the following:

1. That CONTRACTOR WARRANTY has been properly executed and submitted by Contractor.
2. That all sub-contractors and Installers who have provided services on the project have properly executed a SUBCONTRACTOR OR INSTALLER WARRANTY as necessary for each area of work and that each has been submitted by Contractor.
3. That where Contractor Self-Performed trade work or installation, a properly executed CONTRACTOR SELF PERFORMING TRADE WORK OR INSTALLATION WARRANTY has be completed and submitted by Contractor
4. That all requested Manufacturer's Warranties have been prepared specific for this project and submitted by Contractor.
5. That Operations and Maintenance manuals have been provided for all project elements
6. That designated Owner Representative have been appropriately trained on the operation of all equipment and systems
7. That spare parts and excess materials have been provided to designated Owner Representative, where required
8. That all requested or required data has been provided for storage on the Owner's electronic database.
9. That all information and documentation provided on products and services is complete and correct to the Contractor's knowledge.

Affiant: _____
(Contractor)

By:_____
(Print Name)

Title: _____
(Print Title)

Signature: _____
(Above Named Signatory indicates he/she is the authorized representative of Guarantor)

Notary Public: _____

My Commission Expires _____
This _____ day of _____, 20___.

END OF DOCUMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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. Protecting existing vegetation to remain.
2. Removing existing vegetation.
3. Clearing and grubbing.
4. Stripping and stockpiling topsoil.
5. Removing above- and below-grade site improvements.
6. Disconnecting, capping or sealing, and removing site utilities.
7. Temporary erosion- and sedimentation-control measures.

B. Related Sections:
Division 02 Section "Structure Demolition" for demolition of buildings, structures, and site improvements.

1.3 DEFINITIONS

A. Subsoil: All soil beneath the topsoil layer of the soil profile, and typified by the lack of organic matter and soil organisms.
B. Surface Soil: Soil that is present at the top layer of the existing soil profile at the Project site. In undisturbed areas, the surface soil is typically topsoil; but in disturbed areas such as urban environments, the surface soil can be subsoil.
C. Topsoil: Top layer of the soil profile consisting of existing native surface topsoil or existing in-place surface soil and is the zone where plant roots grow. Its appearance is generally friable, pervious, and black or a darker shade of brown, gray, or red than underlying subsoil; diameter; and free of subsoil and weeds, roots, toxic materials, or other nonsoil materials.
D. Plant-Protection Zone: Area surrounding individual trees, groups of trees, shrubs, or other vegetation to be protected during construction, and indicated on Drawings.
E. Tree-Protection Zone: Area surrounding individual trees or groups of trees to be protected during construction, and indicated on Drawings.
F. Vegetation: Trees, shrubs, groundcovers, grass, and other plants.

1.4 MATERIAL OWNERSHIP

A. Except for stripped topsoil and other materials indicated to be stockpiled or otherwise remain Owner's property, cleared materials shall become Contractor's property and shall be removed from Project site.

1.5 SUBMITTALS

A. Existing Conditions: Documentation of existing trees and plantings, adjoining construction, and site improvements that establishes preconstruction conditions that might be misconstrued as damage caused by site clearing.
   1. Use sufficiently detailed photographs or videotape. Include plans and notations to indicate specific wounds and damage conditions of each tree or other plants designated to remain.

B. Record Drawings: Identifying and accurately showing locations of capped utilities and other subsurface structural, electrical, and mechanical conditions.

1.6 QUALITY ASSURANCE

A. Pre-installation Conference: Location TBD

1.7 PROJECT CONDITIONS

A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during site-clearing operations.
   1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
   2. Provide alternate routes around closed or obstructed traffic ways if required by Owner or authorities having jurisdiction.

B. Salvable Improvements: Carefully remove items indicated to be salvaged and store on Owner's premises where indicated.

C. Utility Locator Service: Notify Call 811 Before You Dig for area where Project is located before site clearing.

D. Do not commence site clearing operations until temporary erosion- and sedimentation-control measures are in place.

E. The following practices are prohibited within protection zones:
   1. Storage of construction materials, debris, or excavated material.
   2. Parking vehicles or equipment.
   3. Foot traffic.
   4. Erection of sheds or structures.
   5. Impoundment of water.
   6. Excavation or other digging unless otherwise indicated.
   7. Attachment of signs to or wrapping materials around trees or plants unless otherwise indicated.

F. Soil Stripping, Handling, and Stockpiling: Perform only when the topsoil is dry or slightly

moist.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Satisfactory Soil Material: Requirements for satisfactory soil material are specified in Division 2 Section "Earth Moving."
   1. Obtain approved borrow soil material off-site when satisfactory soil material is not available on-site.

B. Antirust Coating: Fast-curing, lead- and chromate-free, self-curing, universal modified-alkyd primer complying with MPI #79, Alkyd Anticorrosive Metal Primer or SSPC-Paint 20 or SSPC-Paint 29 zinc-rich coating.
   1. Use coating with a VOC content of 420 g/L (3.5 lb/gal.) or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect and maintain benchmarks and survey control points from disturbance during construction.

B. Locate and clearly identify trees, shrubs, and other vegetation to remain or to be relocated. Wrap a 1-inch (25-mm) blue vinyl tie tape flag around each tree trunk at 54 inches (1372 mm) above the ground.

C. Protect existing site improvements to remain from damage during construction.
   1. Restore damaged improvements to their original condition, as acceptable to Owner.

3.2 TEMPORARY EROSION AND SEDIMENTATION CONTROL

A. Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to erosion- and sedimentation-control Drawings and requirements of authorities having jurisdiction.

B. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross protection zones.

C. Inspect, maintain, and repair erosion- and sedimentation-control measures during construction until permanent vegetation has been established.

D. Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

3.3 TREE AND PLANT PROTECTION

A. Repair or replace trees, shrubs, and other vegetation indicated to remain or be relocated that **are** damaged by construction operations, in a manner approved by Engineer.

3.4 EXISTING UTILITIES

A. Owner will arrange for disconnecting and sealing indicated utilities that serve existing structures before site clearing, when requested by Contractor.
   1. Verify that utilities have been disconnected and capped before proceeding with site clearing.
B. Locate, identify, disconnect, and seal or cap utilities indicated to be removed or abandoned in place.
   1. Arrange with utility companies to shut off indicated utilities.
   2. Owner will arrange to shut off indicated utilities when requested by Contractor.
C. Locate, identify, and disconnect utilities indicated to be abandoned in place.
D. Interrupting Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
   1. Notify Architect not less than 72 hours in advance of proposed utility interruptions.
   2. Do not proceed with utility interruptions without Architect's written permission.
E. Excavate for and remove underground utilities indicated to be removed.

3.5 CLEARING AND GRUBBING

A. Remove obstructions, trees, shrubs, and other vegetation to permit installation of new construction.
   1. Do not remove trees, shrubs, and other vegetation indicated to remain or to be relocated.
   2. Grind down stumps and remove roots, obstructions, and debris to a depth of [18 inches (450 mm) below exposed subgrade.
   3. Chip removed tree branches and stockpile in areas approved by Architect.
B. Fill depressions caused by clearing and grubbing operations with satisfactory soil material unless further excavation or earthwork is indicated.
   1. Place fill material in horizontal layers not exceeding a loose depth of 8 inches (200 mm), and compact each layer to a density equal to adjacent original ground.

3.6 TOPSOIL STRIPPING

A. Remove sod and grass before stripping topsoil.
B. Strip topsoil to depth of 6 inches (150 mm) in a manner to prevent intermingling with underlying subsoil or other waste materials.
   1. Remove subsoil and nonsoil materials from topsoil, including clay lumps, gravel, and other objects more than 2 inches (50 mm) in diameter; trash, debris, weeds, roots, and other waste materials.

C. Stockpile topsoil away from edge of excavations without intermixing with subsoil. Grade and shape stockpiles to drain surface water. Cover to prevent windblown dust and erosion by water.
   1. Limit height of topsoil stockpiles to 72 inches (1800 mm).
   2. Dispose of surplus topsoil. Surplus topsoil is that which exceeds quantity indicated to be stockpiled or reused.
   3. Stockpile surplus topsoil to allow for re-spreading deeper topsoil.

3.7 SITE IMPROVEMENTS

A. Remove existing above- and below-grade improvements as indicated and necessary to facilitate new construction.
B. Remove slabs, paving, curbs, gutters, and aggregate base as indicated.
   1. Unless existing full-depth joints coincide with line of demolition, neatly saw-cut along line of existing pavement to remain before removing adjacent existing pavement. Saw-cut faces vertically.
   2. Paint cut ends of steel reinforcement in concrete to remain with two coats of antirust coating, following coating manufacturer's written instructions. Keep paint off surfaces that will remain exposed.

3.8 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Remove surplus soil material, unsuitable topsoil, obstructions, demolished materials, and waste materials including trash and debris, and legally dispose of them off Owner's property.
B. Separate recyclable materials produced during site clearing from other non-recyclable materials. Store or stockpile without intermixing with other materials and transport them to recycling facilities. Do not interfere with other Project work.

END OF SECTION

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. Preparing subgrades for slabs-on-grade, walks, and pavements.
   2. Excavating and backfilling for buildings and structures.
   3. Drainage course for concrete slabs-on-grade.
   4. Subbase course for concrete walks and pavements.
   5. Subbase course and base course for asphalt paving.
   6. Subsurface drainage backfill for walls and trenches.
   7. Excavating and backfilling trenches for utilities and pits for buried utility structures.
   8. Excavating well hole to accommodate elevator-cylinder assembly.

B. Related Sections:
   1. Division 01 Section "Temporary Facilities and Controls" for temporary controls, utilities, and support facilities; also for temporary site fencing if not in another Section.
   2. Division 03 Section "Cast-in-Place Concrete" for granular course if placed over vapor retarder and beneath the slab-on-grade.
   3. Division 2 Section "Site Clearing" for site stripping, grubbing, stripping [and stockpiling] topsoil, and removal of above- and below-grade improvements and utilities.

1.3 UNIT PRICES

A. Rock Measurement: Volume of rock actually removed, measured in original position, but not to exceed the following. Unit prices for rock excavation include replacement with approved materials.
   1. 24 inches (600 mm) outside of concrete forms other than at footings.
   2. 12 inches (300 mm) outside of concrete forms at footings.
   3. 6 inches (150 mm) outside of minimum required dimensions of concrete cast against grade.
   4. Outside dimensions of concrete walls indicated to be cast against rock without forms or exterior waterproofing treatments.
   5. 6 inches (150 mm) beneath bottom of concrete slabs-on-grade.
   6. 6 inches (150 mm) beneath pipe in trenches, and the greater of 24 inches (600 mm) wider than pipe or 42 inches (1065 mm) wide.

1.4 DEFINITIONS

A. Backfill: Soil material or controlled low-strength material used to fill an excavation.
   1. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.
   2. Final Backfill: Backfill placed over initial backfill to fill a trench.

B. Base Course: Aggregate layer placed between the subbase course and hot-mix asphalt paving.
C. Bedding Course: Aggregate layer placed over the excavated subgrade in a trench before laying pipe.
D. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.
E. Drainage Course: Aggregate layer supporting the slab-on-grade that also minimizes upward capillary flow of pore water.
F. Excavation: Removal of material encountered above subgrade elevations and to lines and dimensions indicated.
    1. Authorized Additional Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions as directed by Architect. Authorized additional excavation and replacement material will be paid for according to Contract provisions for unit prices.
    2. Bulk Excavation: Excavation more than 10 feet (3 m) in width and more than 30 feet (9 m) in length.
    3. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by Architect. Unauthorized excavation, as well as remedial work directed by Architect, shall be without additional compensation.
G. Fill: Soil materials used to raise existing grades.
H. Rock: Rock material in beds, ledges, unstratified masses, conglomerate deposits, and boulders of rock material that exceed 1 cu. yd. (0.76 cu. m) for bulk excavation or 3/4 cu. yd. (0.57 cu. M) for footing, trench, and pit excavation that cannot be removed by rock excavating equipment equivalent to the following in size and performance ratings, without systematic drilling, ram hammering, ripping, or blasting, when permitted:
    1. Excavation of Footings, Trenches, and Pits: Late-model, track-mounted hydraulic excavator; equipped with a 42-inch- (1065-mm-) wide, maximum, short-tip-radius rock bucket; rated at not less than 138-hp (103-kW) flywheel power with bucket-curling force of not less than 28,700 lbf (128 kN) and stick-crowd force of not less than 18,400 lbf (82 kN) with extra-long reach boom; measured according to SAE J-1179.
    2. Bulk Excavation: Late-model, track-mounted loader; rated at not less than 230-hp (172-kW) flywheel power and developing a minimum of 47,992-lbf (213.3-kN) breakout force with a general-purpose bare bucket; measured according to SAE J-732.
I. Rock: Rock material in beds, ledges, unstratified masses, conglomerate deposits, and boulders of rock material 3/4 cu. yd. (0.57 cu. m) or more in volume that exceed a standard penetration resistance of 100 blows/2 inches (97 blows/50 mm) when tested by a geotechnical testing agency, according to ASTM D 1586.
J. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.
K. Subbase Course: Aggregate layer placed between the subgrade and base course for hot-mix asphalt pavement, or aggregate layer placed between the subgrade and a cement concrete pavement or a cement concrete or hot-mix asphalt walk.
L. Subgrade: Uppermost surface of an excavation or the top surface of a fill or backfill immediately below subbase, drainage fill, drainage course, or topsoil materials.
M. Utilities: On-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.

1.5 SUBMITTALS

A. Product Data: For each type of the following manufactured products required:
   1. Geotextiles.
   2. Controlled low-strength material, including design mixture.
   3. Geofoam.
   4. Warning tapes.
B. Samples for Verification: For the following products, in sizes indicated below:
   1. Geotextile: 12 by 12 inches (300 by 300 mm).
   2. Warning Tape: 12 inches (300 mm) long; of each color.
C. Qualification Data: For qualified testing agency.
D. Material Test Reports: For each on-site and borrow soil material proposed for fill and backfill as follows:
   1. Classification according to ASTM D 2487.
   2. Laboratory compaction curve according to ASTM D 698.
E. Pre-excavation Photographs or Videotape: Show existing conditions of adjoining construction and site improvements, including finish surfaces, that might be misconstrued as damage caused by earth moving operations. Submit before earth moving begins.

1.6 QUALITY ASSURANCE

A. Blasting: Comply with applicable requirements in NFPA 495, "Explosive Materials Code," and prepare a blasting plan reporting the following:
   1. Types of explosive and sizes of charge to be used in each area of rock removal, types of blasting mats, sequence of blasting operations, and procedures that will prevent damage to site improvements and structures on Project site and adjacent properties.
   2. Seismographic monitoring during blasting operations.
B. Seismic Survey Agency: An independent testing agency, acceptable to authorities having jurisdiction, experienced in seismic surveys and blasting procedures to perform the following services:
   1. Report types of explosive and sizes of charge to be used in each area of rock removal, types of blasting mats, sequence of blasting operations, and procedures that will prevent damage to site improvements and structures on Project site and adjacent properties.
   2. Seismographic monitoring during blasting operations.
C. Geotechnical Testing Agency Qualifications: Qualified according to ASTM E 329 and ASTM D 3740 for testing indicated.
D. Pre-excavation Conference: Held at project site or location designated by Owners respenstative.

1.7 PROJECT CONDITIONS

A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during earth moving operations.
   1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
   2. Provide alternate routes around closed or obstructed traffic ways if required by Owner or authorities having jurisdiction.
B. Improvements on Adjoining Property: Authority for performing earth moving indicated on property

adjoining Owner's property will be obtained by Owner before award of Contract.
1. Do not proceed with work on adjoining property until directed by Architect.

C. Utility Locator Service: Notify "Call Before You Dig" (811) for area where Project is located before beginning earth moving operations.

D. Do not commence earth moving operations until temporary erosion- and sedimentation-control measures, specified in Division 2 Section "Site Clearing," and the Civil Plans are in place.

E. The following practices are prohibited within protection zones:
1. Storage of construction materials, debris, or excavated material.
2. Parking vehicles or equipment.
3. Foot traffic.
4. Erection of sheds or structures.
5. Impoundment of water.
6. Excavation or other digging unless otherwise indicated.
7. Attachment of signs to or wrapping materials around trees or plants unless otherwise indicated.

F. Do not direct vehicle or equipment exhaust towards protection zones.

G. Prohibit heat sources, flames, ignition sources, and smoking within or near protection zones.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

A. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations.

B. Satisfactory Soils: Soil Classification Groups GW, GP, GM, SW, SP, and SM according to ASTM D 2487, or a combination of these groups; free of rock or gravel larger than 3 inches (75 mm) in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter. It is recommended that the services of a geotechnical engineer be retained to certify to the quality of the fill material.

C. Unsatisfactory Soils: Soil Classification Groups GC, SC, CL, ML, OL, CH, MH, OH, and PT according to ASTM D 2487, or a combination of these groups.
1. Unsatisfactory soils also include satisfactory soils not maintained within 2 percent of optimum moisture content at time of compaction.

D. Subbase Material: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 90 percent passing a 1-1/2-inch (37.5-mm) sieve and not more than 12 percent passing a No. 200 (0.075-mm) sieve.

E. Base Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 95 percent passing a 1-1/2-inch (37.5-mm) sieve and not more than 8 percent passing a No. 200 (0.075-mm) sieve.

F. Engineered Fill: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 90 percent passing a 1-1/2-inch (37.5-mm) sieve and not more than 12 percent passing a No. 200 (0.075-mm) sieve.

G. Bedding Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; except with 100 percent passing a 1-inch (25-mm) sieve and not more than 8 percent passing a No. 200 (0.075-mm) sieve.

H. Drainage Course: Narrowly graded mixture of washed crushed stone, or crushed or uncrushed

gravel; ASTM D 448; coarse-aggregate grading Size 57; with 100 percent passing a 1-1/2-inch (37.5-mm) sieve and 0 to 5 percent passing a No. 8 (2.36-mm) sieve.

I. Filter Material: Narrowly graded mixture of natural or crushed gravel, or crushed stone and natural sand; ASTM D 448; coarse-aggregate grading Size 67; with 100 percent passing a 1-inch (25-mm) sieve and 0 to 5 percent passing a No. 4 (4.75-mm) sieve.

J. Sand: ASTM C 33; fine aggregate.

K. Impervious Fill: Clayey gravel and sand mixture capable of compacting to a dense state.

2.2 GEOTEXTILES

A. Subsurface Drainage Geotextile: Nonwoven needle-punched geotextile, manufactured for subsurface drainage applications, made from polyolefins or polyesters; with elongation greater than 50 percent; complying with AASHTO M 288 and the following, measured per test methods referenced:
   1. Survivability: Class 2; AASHTO M 288.
   2. Grab Tensile Strength: 157 lbf (700 N); ASTM D 4632.
   3. Sewn Seam Strength: 142 lbf (630 N); ASTM D 4632.
   4. Tear Strength: 56 lbf (250 N); ASTM D 4533.
   5. Puncture Strength: 56 lbf (250 N); ASTM D 4833.
   6. Apparent Opening Size: [No. 60 (0.250-mm) sieve, maximum; ASTM D 4751.
   7. Permittivity: [0.2 per second, minimum; ASTM D 4491.
   8. UV Stability: 50 percent after 500 hours' exposure; ASTM D 4355.

B. Separation Geotextile: Woven geotextile fabric, manufactured for separation applications, made from polyolefins or polyesters; with elongation less than 50 percent; complying with AASHTO M 288 and the following, measured per test methods referenced:
   1. Survivability: Class 2; AASHTO M 288.
   2. Grab Tensile Strength: 247 lbf (1100 N); ASTM D 4632.
   3. Sewn Seam Strength: 222 lbf (990 N); ASTM D 4632.
   4. Tear Strength: 90 lbf (400 N); ASTM D 4533.
   5. Puncture Strength: 90 lbf (400 N); ASTM D 4833.
   6. Apparent Opening Size: No. 60 (0.250-mm) sieve, maximum; ASTM D 4751.
   7. Permittivity: 0.02 per second, minimum; ASTM D 4491.
   8. UV Stability: 50 percent after 500 hours' exposure; ASTM D 4355.

2.3 ACCESSORIES

A. Warning Tape: Acid- and alkali-resistant, polyethylene film warning tape manufactured for marking and identifying underground utilities, 6 inches (150 mm) wide and 4 mils (0.1 mm) thick, continuously inscribed with a description of the utility; colored as follows:
   1. Red: Electric.
   2. Yellow: Gas, oil, steam, and dangerous materials.
   3. Orange: Telephone and other communications.
   4. Blue: Water systems.
   5. Green: Sewer systems.

B. Detectable Warning Tape: Acid- and alkali-resistant, polyethylene film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches (150 mm) wide and 4 mils (0.1 mm) thick, continuously inscribed with a description of the utility, with metallic core encased in

a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches (750 mm) deep; colored as follows:

1. Red: Electric.
2. Yellow: Gas, oil, steam, and dangerous materials.
3. Orange: Telephone and other communications.
4. Blue: Water systems.
5. Green: Sewer systems.

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earth moving operations.

B. Protect and maintain erosion and sedimentation controls during earth moving operations.

C. Protect subgrades and foundation soils from freezing temperatures and frost. Remove temporary protection before placing subsequent materials.

3.2 DEWATERING

A. Prevent surface water and ground water from entering excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area.

B. Protect subgrades from softening, undermining, washout, and damage by rain or water accumulation.

1. Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations. Do not use excavated trenches as temporary drainage ditches.

3.3 EXPLOSIVES

A. Explosives: Do not use explosives.

3.4 EXCAVATION, GENERAL

A. Unclassified Excavation: Excavate to subgrade elevations regardless of the character of surface and subsurface conditions encountered. Unclassified excavated materials may include rock, soil materials, and obstructions. No changes in the Contract Sum or the Contract Time will be authorized for rock excavation or removal of obstructions.

1. If excavated materials intended for fill and backfill include unsatisfactory soil materials and rock, replace with satisfactory soil materials.
2. Remove rock to lines and grades indicated to permit installation of permanent construction without exceeding the following dimensions:
    a. 24 inches (600 mm) outside of concrete forms other than at footings.
    b. 12 inches (300 mm) outside of concrete forms at footings.
    c. 6 inches (150 mm) outside of minimum required dimensions of concrete cast against grade.
    d. Outside dimensions of concrete walls indicated to be cast against rock without forms

or exterior waterproofing treatments.

e. 6 inches (150 mm) beneath bottom of concrete slabs-on-grade.

f. 6 inches (150 mm) beneath pipe in trenches, and the greater of 24 inches (600 mm) wider than pipe or 42 inches (1065 mm) wide.

B. Classified Excavation: Excavate to subgrade elevations. Material to be excavated will be classified as earth and rock. Do not excavate rock until it has been classified and cross sectioned by Architect. The Contract Sum will be adjusted for rock excavation according to unit prices included in the Contract Documents. Changes in the Contract Time may be authorized for rock excavation.

1. Earth excavation includes excavating pavements and obstructions visible on surface; underground structures, utilities, and other items indicated to be removed; together with soil, boulders, and other materials not classified as rock or unauthorized excavation.
   a. Intermittent drilling; blasting, if permitted; ram hammering; or ripping of material not classified as rock excavation is earth excavation.
2. Rock excavation includes removal and disposal of rock. Remove rock to lines and subgrade elevations indicated to permit installation of permanent construction without exceeding the following dimensions:
   a. 24 inches (600 mm) outside of concrete forms other than at footings.
   b. 12 inches (300 mm) outside of concrete forms at footings.
   c. [6 inches (150 mm) outside of minimum required dimensions of concrete cast against grade.
   d. Outside dimensions of concrete walls indicated to be cast against rock without forms or exterior waterproofing treatments.
   e. 6 inches (150 mm) beneath bottom of concrete slabs-on-grade.
   f. 6 inches (150 mm) beneath pipe in trenches, and the greater of 24 inches (600 mm) wider than pipe or 42 inches (1065 mm) wide.

3.5 EXCAVATION FOR STRUCTURES

A. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 1 inch (25 mm). If applicable, extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, and for inspections.

1. Excavations for Footings and Foundations: Do not disturb bottom of excavation. Excavate by hand to final grade just before placing concrete reinforcement. Trim bottoms to required lines and grades to leave solid base to receive other work.
2. Pile Foundations: Stop excavations 6 to 12 inches (150 to 300 mm) above bottom of pile cap before piles are placed. After piles have been driven, remove loose and displaced material. Excavate to final grade, leaving solid base to receive concrete pile caps.
3. Excavation for Underground Tanks, Basins, and Mechanical or Electrical Utility Structures: Excavate to elevations and dimensions indicated within a tolerance of plus or minus 1 inch (25 mm). Do not disturb bottom of excavations intended as bearing surfaces.

B. Excavations at Edges of Tree- and Plant-Protection Zones:

1. Excavate by hand to indicated lines, cross sections, elevations, and subgrades. Use narrow-tine spading forks to comb soil and expose roots. Do not break, tear, or chop exposed roots. Do not use mechanical equipment that rips, tears, or pulls roots.
2. Cut and protect roots according to local AHJ Recommendations.

3.6 EXCAVATION FOR WALKS AND PAVEMENTS

A. Excavate surfaces under walks and pavements to indicated lines, cross sections, elevations, and subgrades.

3.7 EXCAVATION FOR UTILITY TRENCHES

A. Excavate trenches to indicated gradients, lines, depths, and elevations.
   1. Beyond building perimeter, excavate trenches to allow installation of top of pipe below frost line.

B. Excavate trenches to uniform widths to provide the following clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches (300 mm) higher than top of pipe or conduit unless otherwise indicated.
   1. Clearance: 12 inches (300 mm) each side of pipe or conduit.

C. Trench Bottoms: Excavate and shape trench bottoms to provide uniform bearing and support of pipes and conduit. Shape subgrade to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits. Remove projecting stones and sharp objects along trench subgrade.
   1. For pipes and conduit less than 6 inches (150 mm) in nominal diameter, hand-excavate trench bottoms and support pipe and conduit on an undisturbed subgrade.
   2. For pipes and conduit 6 inches (150 mm) or larger in nominal diameter, shape bottom of trench to support bottom 90 degrees of pipe or conduit circumference. Fill depressions with tamped sand backfill.
   3. For flat-bottomed, multiple-duct conduit units, hand-excavate trench bottoms and support onduit on an undisturbed subgrade.
   4. Excavate trenches 6 inches (150 mm) deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.

D. Trench Bottoms: Excavate trenches 4 inches (100 mm) deeper than bottom of pipe and conduit elevations to allow for bedding course. Hand-excavate deeper for bells of pipe.
   1. Excavate trenches 6 inches (150 mm) deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.

E. Trenches in Tree- and Plant-Protection Zones:
   1. Hand-excavate to indicated lines, cross sections, elevations, and subgrades. Use narrow-tine spading forks to comb soil and expose roots. Do not break, tear, or chop exposed roots. Do not use mechanical equipment that rips, tears, or pulls roots.
   2. Do not cut main lateral roots or taproots; cut only smaller roots that interfere with installation of utilities.
   3. Cut and protect roots according to Local AHJ Recommendations.

3.8 SUBGRADE INSPECTION

A. Notify Architect when excavations have reached required subgrade.

B. If Architect determines that unsatisfactory soil is present, continue excavation and replace with compacted backfill or fill material as directed.

C. Proof-roll subgrade below the building slabs and pavements with a pneumatic-tired and loaded 10-wheel, tandem-axle dump truck weighing not less than 15 tons (13.6 tonnes) to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.

1. Completely proof-roll subgrade in one direction, repeating proof-rolling in direction perpendicular to first direction. Limit vehicle speed to 3 mph (5 km/h).
2. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Architect, and replace with compacted backfill or fill as directed.

D. Authorized additional excavation and replacement material will be paid for according to Contract provisions for unit prices.

E. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Architect, without additional compensation.

3.9 UNAUTHORIZED EXCAVATION

A. Fill unauthorized excavation under foundations or wall footings by extending bottom elevation of concrete foundation or footing to excavation bottom, without altering top elevation. Lean concrete fill, with 28-day compressive strength of 2500 psi (17.2 MPa), may be used when approved by Architect.
   1. Fill unauthorized excavations under other construction, pipe, or conduit as directed by Architect.

3.10 STORAGE OF SOIL MATERIALS

A. Stockpile borrow soil materials and excavated satisfactory soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
   1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

3.11 BACKFILL

A. Place and compact backfill in excavations promptly, but not before completing the following:
   1. Construction below finish grade including, where applicable, subdrainage, dampproofing, waterproofing, and perimeter insulation.
   2. Surveying locations of underground utilities for Record Documents.
   3. Testing and inspecting underground utilities.
   4. Removing concrete formwork.
   5. Removing trash and debris.
   6. Removing temporary shoring and bracing, and sheeting.
   7. Installing permanent or temporary horizontal bracing on horizontally supported walls.

B. Place backfill on subgrades free of mud, frost, snow, or ice.

3.12 UTILITY TRENCH BACKFILL

A. Place backfill on subgrades free of mud, frost, snow, or ice.

B. Place and compact bedding course on trench bottoms and where indicated. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.

C. Trenches under Footings: Backfill trenches excavated under footings and within 18 inches (450 mm) of bottom of footings with satisfactory soil; fill with concrete to elevation of bottom of footings. Concrete is specified in Division 03 Section “Cast-in-Place Concrete."

D. Trenches under Roadways: Provide 4-inch- (100-mm-) thick, concrete-base slab support for piping or conduit less than 30 inches (750 mm) below surface of roadways. After installing and testing, completely encase piping or conduit in a minimum of 4 inches (100 mm) of concrete before backfilling or placing roadway subbase course. Concrete is specified in Division 03 Section "Cast-in-Place Concrete."
E. Backfill voids with satisfactory soil while removing shoring and bracing.
F. Place and compact initial backfill of subbase material, free of particles larger than 1 inch (25 mm) in any dimension, to a height of 12 inches (300 mm) over the pipe or conduit.
   1. Carefully compact initial backfill under pipe haunches and compact evenly up on both sides and along the full length of piping or conduit to avoid damage or displacement of piping or conduit. Coordinate backfilling with utilities testing.
G. Controlled Low-Strength Material: Place initial backfill of controlled low-strength material to a height of 12 inches (300 mm) over the pipe or conduit. Coordinate backfilling with utilities testing.
H. Place and compact final backfill of satisfactory soil to final subgrade elevation.
I. Controlled Low-Strength Material: Place final backfill of controlled low-strength material to final subgrade elevation.
J. Install warning tape directly above utilities, 12 inches (300 mm) below finished grade, except 6 inches (150 mm) below subgrade under pavements and slabs.

3.13 SOIL FILL

A. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material.
B. Place and compact fill material in layers to required elevations as follows:
   1. Under grass and planted areas, use satisfactory soil material.
   2. Under walks and pavements, use satisfactory soil material.
   3. Under steps and ramps, use engineered fill.
   4. Under building slabs, use engineered fill.
   5. Under footings and foundations, use engineered fill.
C. Place soil fill on subgrades free of mud, frost, snow, or ice.

3.14 SOIL MOISTURE CONTROL

A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before compaction to within 2 percent of optimum moisture content.
   1. Do not place backfill or fill soil material on surfaces that are muddy, frozen, or contain frost or ice.
   2. Remove and replace, or scarify and air dry, otherwise satisfactory soil material that exceeds optimum moisture content by 2 percent and is too wet to compact to specified dry unit weight.

3.15 COMPACTION OF SOIL BACKFILLS AND FILLS

A. Place backfill and fill soil materials in layers not more than [8 inches (200 mm)] in loose depth for material compacted by heavy compaction equipment, and not more than 4 inches (100 mm) in loose depth for material compacted by hand-operated tampers.
B. Place backfill and fill soil materials evenly on all sides of structures to required elevations, and uniformly along the full length of each structure.

C. Compact soil materials to not less than the following percentages of maximum dry unit weight according to ASTM D 698:
   1. Under structures, building slabs, steps, and pavements, scarify and recompact top 12 inches (300 mm) of existing subgrade and each layer of backfill or fill soil material at 98 percent.
   2. Under walkways, scarify and recompact top 6 inches (150 mm) below subgrade and compact each layer of backfill or fill soil material at 95 percent.
   3. Under turf or unpaved areas, scarify and recompact top 6 inches (150 mm) below subgrade and compact each layer of backfill or fill soil material at 85 percent.
   4. For utility trenches, compact each layer of initial and final backfill soil material at 90 percent.

D. When soil is deem too wet for proper compaction, the Contractor shall spread soil around the site for drying soil to achieve optimum moisture content.

3.16 GRADING

A. General: Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.
   1. Provide a smooth transition between adjacent existing grades and new grades.
   2. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.

B. Site Rough Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to required elevations within the following tolerances:
   1. Turf or Unpaved Areas: Plus or minus 1 inch (25 mm).
   2. Walks: Plus or minus 1 inch (25 mm).
   3. Pavements: Plus or minus 1/2 inch (13 mm).

C. Grading inside Building Lines: Finish subgrade to a tolerance of 1/2 inch (13 mm) when tested with a 10-foot (3-m) straightedge.

D. Drainage Backfill: Place and compact filter material over subsurface drain, in width indicated, to within 12 inches (300 mm) of final subgrade, in compacted layers 6 inches (150 mm) thick. Overlay drainage backfill with one layer of subsurface drainage geotextile, overlapping sides and ends at least 6 inches (150 mm).
   1. Compact each filter material layer to 90 percent of maximum dry unit weight according to ASTM D 698.
   2. Place and compact impervious fill over drainage backfill in 6-inch- (150-mm-) thick compacted layers to final subgrade.

3.17 SUBBASE AND BASE COURSES UNDER PAVEMENTS AND WALKS

A. Place subbase course and base course on subgrades free of mud, frost, snow, or ice.

B. On prepared subgrade, place subbase course and base course under pavements and walks as follows:
   1. Install separation geotextile on prepared subgrade according to manufacturer's written instructions, overlapping sides and ends.
   2. Place base course material over subbase course under hot-mix asphalt pavement.
   3. Shape subbase course and base course to required crown elevations and cross-slope grades.
   4. Place subbase course and base course 6 inches (150 mm) or less in compacted thickness in

a single layer.

5. Place subbase course and base course that exceeds 6 inches (150 mm) in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches (150 mm) thick or less than 3 inches (75 mm) thick.
6. Compact subbase course and base course at optimum moisture content to required grades, lines, cross sections, and thickness to not less than 98 percent of maximum dry unit weight according to ASTM D 698.

3.18 DRAINAGE COURSE UNDER CONCRETE SLABS-ON-GRADE

A. Place drainage course on subgrades free of mud, frost, snow, or ice.
B. On prepared subgrade, place and compact drainage course under cast-in-place concrete slabs-on-grade as follows:
   1. Install subdrainage geotextile on prepared subgrade according to manufacturer's written instructions, overlapping sides and ends.
   2. Place drainage course 6 inches (150 mm) or less in compacted thickness in a single layer.
   3. Place drainage course that exceeds 6 inches (150 mm) in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches (150 mm) thick or less than 3 inches (75 mm) thick.
   4. Compact each layer of drainage course to required cross sections and thicknesses to not less than 98 percent of maximum dry unit weight according to ASTM D 698.

3.19 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a qualified special inspector to perform the following special inspections:
   1. Determine prior to placement of fill that site has been prepared in compliance with requirements.
   2. Determine that fill material and maximum lift thickness comply with requirements.
   3. Determine, at the required frequency, that in-place density of compacted fill complies with requirements.
B. Testing Agency: Owner will engage a qualified geotechnical engineering testing agency to perform tests and inspections.
C. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earth moving only after test results for previously completed work comply with requirements.
D. Footing Subgrade: At footing subgrades, at least one test of each soil stratum will be performed to verify design bearing capacities. Subsequent verification and approval of other footing subgrades may be based on a visual comparison of subgrade with tested subgrade when approved by Architect.
E. Testing agency will test compaction of soils in place according to ASTM D 1556, ASTM D 2167, ASTM D 2922, and ASTM D 2937, as applicable. Tests will be performed at the following locations and frequencies:
   1. Paved and Building Slab Areas: At subgrade and at each compacted fill and backfill layer, at least one test for every 2000 sq. ft. (186 sq. m) or less of paved area or building slab, but in no case fewer than three tests.
   2. Foundation Wall Backfill: At each compacted backfill layer, at least one test for every 100

feet (30 m) or less of wall length, but no fewer than two tests.

3. Trench Backfill: At each compacted initial and final backfill layer, at least one test for every 150 feet (46 m) or less of trench length, but no fewer than two tests.

F. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil materials to depth required; recompact and retest until specified compaction is obtained.

3.20 PROTECTION

A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.

B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.

1. Scarify or remove and replace soil material to depth as directed by Architect; reshape and recompact.

C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.

1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

3.21 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Remove surplus satisfactory soil and waste materials, including unsatisfactory soil, trash, and debris, and legally dispose of them off Owner's property.

B. Transport surplus satisfactory soil to designated storage areas on Owner's property. Stockpile or spread soil as directed by Architect.

1. Remove waste materials, including unsatisfactory soil, trash, and debris, and legally dispose of them off Owner's property.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes construction dewatering.
B. Related Sections:
1. Division 2 Section "Earth Moving" for excavating, backfilling, site grading, and for site utilities.

1.3 PERFORMANCE REQUIREMENTS

A. Dewatering Performance: Design, furnish, install, test, operate, monitor, and maintain dewatering system of sufficient scope, size, and capacity to control hydrostatic pressures and to lower, control, remove, and dispose of ground water and permit excavation and construction to proceed on dry, stable subgrades.
1. Delegated Design: Design dewatering system, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
2. Continuously monitor and maintain dewatering operations to ensure erosion control, stability of excavations and constructed slopes, that excavation does not flood, and that damage to subgrades and permanent structures is prevented.
3. Prevent surface water from entering excavations by grading, dikes, or other means.
4. Accomplish dewatering without damaging existing buildings, structures, and site improvements adjacent to excavation.
5. Remove dewatering system when no longer required for construction.

1.4 SUBMITTALS

A. Shop Drawings: For dewatering system. Show arrangement, locations, and details of wells and well points; locations of risers, headers, filters, pumps, power units, and discharge lines; and means of discharge, control of sediment, and disposal of water.
1. Include layouts of piezometers and flow-measuring devices for monitoring performance of dewatering system.
2. Include a written plan for dewatering operations including control procedures to be adopted if dewatering problems arise.
B. Delegated-Design Submittal: For dewatering system indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
C. Qualification Data: For qualified Installer.
D. Field quality-control reports.

E. Other Informational Submittals:
   1. Photographs: Show existing conditions of adjoining construction and site improvements that might be misconstrued as damage caused by dewatering operations.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer that has specialized in design of dewatering systems and dewatering work.
B. Regulatory Requirements: Comply with governing EPA notification regulations before beginning dewatering. Comply with hauling and disposal regulations of authorities having jurisdiction.

1.5 PROJECT CONDITIONS

A. Survey Work: Engage a qualified land surveyor or professional engineer to survey adjacent existing buildings, structures, and site improvements, establishing exact elevations at fixed points to act as benchmarks. Clearly identify benchmarks and record existing elevations.
   1. During dewatering, regularly resurvey benchmarks, maintaining an accurate log of surveyed elevations for comparison with original elevations. Promptly notify Architect if changes in elevations occur or if cracks, sags, or other damage is evident in adjacent construction.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by dewatering operations.
   1. Prevent surface water and subsurface or ground water from entering excavations, from ponding on prepared subgrades, and from flooding site and surrounding area.
   2. Protect subgrades and foundation soils from softening and damage by rain or water accumulation.
B. Install dewatering system to ensure minimum interference with roads, streets, walks, and other adjacent occupied and used facilities.
   1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.
C. Provide temporary grading to facilitate dewatering and control of surface water.
D. Monitor dewatering systems continuously.
E. Promptly repair damages to adjacent facilities caused by dewatering.
F. Protect and maintain temporary erosion and sedimentation controls, which are specified in Division 2 Section "Site Clearing" and in the approved Civil plans during dewatering operations.

3.2 INSTALLATION

A. Install dewatering system utilizing wells, well points, or similar methods complete with pump equipment, standby power and pumps, filter material gradation, valves, appurtenances, water

disposal, and surface-water controls.

1. Space well points or wells at intervals required to provide sufficient dewatering.
2. Use filters or other means to prevent pumping of fine sands or silts from the subsurface.

B. Before excavating below ground-water level, place system into operation to lower water to specified levels. Operate system continuously until drains, sewers, and structures have been constructed and fill materials have been placed or until dewatering is no longer required.

C. Provide an adequate system to lower and control ground water to permit excavation, construction of structures, and placement of fill materials on dry subgrades. Install sufficient dewatering equipment to drain water-bearing strata above and below bottom of foundations, drains, sewers, and other excavations.

1. Do not permit open-sump pumping that leads to loss of fines, soil piping, subgrade softening, and slope instability.

D. Reduce hydrostatic head in water-bearing strata below subgrade elevations of foundations, drains, sewers, and other excavations.

1. Maintain piezometric water level a minimum of 60 inches (1500 mm) below surface of excavation.

E. Dispose of water removed by dewatering in a manner that avoids endangering public health, property, and portions of work under construction or completed. Dispose of water and sediment in a manner that avoids inconvenience to others. Provide sumps, sedimentation tanks, and other flow-control devices as required by authorities having jurisdiction.

F. Provide standby equipment on site, installed and available for immediate operation, to maintain dewatering on continuous basis if any part of system becomes inadequate or fails. If dewatering requirements are not satisfied due to inadequacy or failure of dewatering system, restore damaged structures and foundation soils at no additional expense to Owner.

1. Remove dewatering system from Project site on completion of dewatering. Plug or fill well holes with sand or cut off and cap wells a minimum of 36 inches (900 mm) below overlying construction.

G. Damages: Promptly repair damages to adjacent facilities caused by dewatering operations.

3.3 FIELD QUALITY CONTROL

A. Observation Wells: Provide, take measurements, and maintain at least the minimum number of observation wells or piezometers indicated; additional observation wells may be required by authorities having jurisdiction.

1. Observe and record daily elevation of ground water and piezometric water levels in observation wells.
2. Repair or replace, within 24 hours, observation wells that become inactive, damaged, or destroyed. In areas where observation wells are not functioning properly, suspend construction activities until reliable observations can be made. Add or remove water from observation-well risers to demonstrate that observation wells are functioning properly.
3. Fill observation wells, remove piezometers, and fill holes when dewatering is completed.

B. Provide continual observation to ensure that subsurface soils are not being removed by the dewatering operation.

END OF SECTION

Part 1 General

1.01 Scope

A. The Work specified in this Section consists of providing and maintaining temporary and permanent erosion and sedimentation controls as shown on the Drawings. This Section also specifies the subsequent removal of temporary erosion and sedimentation controls.

B. Temporary and permanent erosion and sedimentation controls include grassing and mulching of disturbed areas and structural barriers at those locations which will ensure that erosion during construction will be maintained within acceptable limits. Acceptable limits are as established by the Georgia Erosion and Sedimentation Control Act of 1975, as amended, Section 402 of the Federal Clean Water Act, and applicable codes, ordinances, rules, regulations, and laws of local, state, and municipal authorities having jurisdiction.

C. Land disturbance activity shall not commence until the Land Disturbance Permit has been issued.

1.02 Submittals

Submit product data in accordance with the requirements of DIVISION 1 of these Specifications.

1.03 Quality Assurance

A. The temporary and permanent erosion and sedimentation control measures shown on the Drawings are minimum requirements. Any additional erosion and sedimentation control measures required by the Contractor's means, methods, techniques, and sequence of operation will be installed by the Contractor at no additional cost to the Owner.

B. Perform all Work under this Section in accordance with all pertinent rules and regulations including, but not necessarily limited to, those stated in these Specifications. Where provisions of pertinent rules and regulations conflict with these Specifications the more stringent provisions shall govern.

C. Provide all materials and promptly take all actions necessary to achieve effective erosion and sedimentation control in accordance with the Georgia Erosion and Sedimentation Control Act of 1975 as amended (OCGA §12-7-1, et. seq.), local ordinances, other permits, local enforcing agency guidelines, and these Specifications.

D. Basic Principles:

1. Coordinate the land disturbance activities to fit the topography, soil types, and conditions.

2. Minimize the disturbed area and the duration of exposure to erosive elements.

3. Provide temporary or permanent stabilization to disturbed areas immediately after rough grading is complete.

4. Safely convey run-off from the site to a stable outlet to prevent flooding and damage to downstream facilities resulting from increased runoff from the site.

5. Retain sediment on-site that was generated on-site.

6. Minimize encroachment upon watercourses.

E. Implementation:

1. The Contractor is solely responsible for the control of erosion within the Project site and the prevention of sedimentation from leaving the Project site or entering waterways.

2. The Contractor shall install temporary and permanent erosion and sedimentation controls which will ensure that runoff from the disturbed area of the Project site shall pass through a filter system before exiting the Project site.

3. The Contractor shall provide temporary and permanent erosion and sedimentation control measures to prevent silt and sediment from entering the waterways and designated wetland areas. The Contractor shall maintain an undisturbed vegetative buffer a minimum of 25 feet from the top of the bank.

4. The Contractor shall limit land disturbance activity to those areas shown on the Drawings.

5. The Contractor shall maintain erosion and sedimentation control measures within disturbed areas on the entire site at no additional cost to the Owner until the final acceptance of the Project. Maintenance shall include mulching, re-seeding, clean-out of sediment barriers and sediment ponds, replacement of washed-out or undermined rip rap and erosion control materials, to the satisfaction of the Owner and Landscape Architect.

6. All fines imposed for improper erosion and sedimentation control shall be paid by the Contractor.

Part 2 Products

2.01 Sediment Barrier

A. Silt Fence:

1. Type A silt fence shall meet the requirements of Section 171 of the Georgia Department of Transportation Standard Specifications, latest edition.

2. Type C Silt Fence is a combination of Type A silt Fence with woven wire reinforcement. Type C Silt Fence reinforcement shall meet the requirements of Section 171 of Georgia D.O.T. Specifications.

3. Silt fence fabric shall be an approved product on the Georgia DOT Qualified Product List No. 36, latest edition.

B. Hay Bales: Hay bales shall be clean, seed-free cereal hay, rectangular in shape, and contain five cubic feet or more of material.

C. Concrete Blocks: Concrete blocks shall be hollow, non-load-bearing type.

D. Plywood shall be 3/4-inch thick exterior type.

2.02 Construction Exit Stone

Use sound, tough, durable stone resistant to the action of air and water. Slabby or shaley pieces will not be acceptable. Aggregate size shall be in accordance with the National Stone Association Size R-2 (1.5 to 3.5-inch stone) or Type 3 rip rap stone conforming to Section 805.01 of the Georgia Department of Transportation Standard Specifications.

2.03 Concrete

Concrete shall conform to the requirements specified in Section 03300 of these Specifications for 3000 psi concrete.

2.04 Rip Rap

A. Stone Rip Rap: Use sound, tough, durable stones resistant to the action of air and unless noted otherwise, stone rip rap shall be Type 1.

1. It is most desirable to utilize “River Rock” for riprap installation on this Project for aesthetic reasons. The size and gradation of the riprap shall generally conform to the referenced Georgia DOT Standards. The River Rock size and gradation shall be submitted as a shop drawing to the Project Landscape Architect for review and approval.

2. Type 1 Rip Rap: Rip rap size and gradation shall conform to Section 805.01 of the Georgia Department of Transportation Standard Specification for Type 1 Stone Dumped Rip Rap.

3. Type 3 Rip Rap: Rip rap size and gradation shall conform to Section 805.01 of the Georgia Department of Transportation Standard Specifications for Type 3 Stone Dumped Rip Rap.

2.05 Plastic Filter Fabric

A. Plastic filter fabric shall conform to the Georgia Department of Transportation Standard Specifications, Section 881.06 for non-woven filter fabrics on most applications for this Project, except for underneath riprap areas or stone construction entrances.

B. Plastic filter fabric shall be an approved product on the Georgia Department of Transportation Qualified Product List No. 28, latest edition.

2.06 Grassing

A. Grassing materials shall meet the requirements of the following sections of the Georgia Department of Transportation Standard Specifications, latest edition:

Material	Section
Topsoil	893.01
Seed and Sod	890
Fertilizer	891.01
Agricultural Lime	882.02
Mulch	893.02
Inoculants	893.04

B. Seed species shall be provided as shown on the Drawings.

C. Mulch Binder: Mulch on slopes exceeding 3 (horizontal) to 1 (vertical) shall be held in place by the use of a mulch binder, as approved by the Project Landscape Architect. The mulch binder shall be non-toxic to plant and animal life and shall be approved by the Project Landscape Architect.

D. Water: Water shall be free of excess and harmful chemicals, organisms, and substances which may be harmful to plant growth or obnoxious to traffic. Salt or brackish water shall not be used. Water shall be furnished by the Contractor.

Part 3 Execution

3.01 General

A. Temporary and permanent erosion and sedimentation control measures shall prevent erosion and prevent sediment from exiting the site. If, in the opinion of the Owner or Project Landscape Architect, the Contractor's temporary erosion and sedimentation control measures are inadequate, the Contractor shall provide additional maintenance for existing measures or additional devices to control erosion and sedimentation on the site at no additional cost to the Owner.

B. All erosion and sedimentation control devices and structures shall be inspected by the Contractor at least once a week and immediately after each rainfall occurrence. Any device or structure found to be damaged shall be repaired or replaced by the end of the day.

C. All erosion and sedimentation control measures and devices shall be constructed and maintained as indicated on the Drawings or specified herein until adequate permanent disturbed area stabilization has been provided and accepted by the Project Landscape Architect. Once adequate permanent stabilization has been provided and accepted by the Project Landscape Architect, all temporary erosion and sedimentation control structures and devices shall be removed.

3.02 Sediment Control

A. Construction Exit:

1. Construction exit(s) shall be placed as shown on the Drawings and as directed by the Project Landscape Architect. A construction exit shall be located at any point traffic will be leaving a disturbed area to a public right-of-way, street, alley, sidewalk, or parking area.

2. Placement of Construction Exit Material: The ground surface upon which the construction exit material is to be placed shall be prepared to a smooth condition free from obstructions, depressions or debris. The plastic filter fabric shall be placed to provide a minimum number of overlaps and a minimum width of one foot of overlap at each joint. The stone shall be placed with its top elevation conforming to the surrounding roadway elevations. The stone shall be dropped no more than three feet during construction.

3. Construction Exit Maintenance: The Contractor shall regularly maintain the exit with the top dressing of stone to prevent tracking or flow of soil onto public rights-of-way and paved surfaces as directed by the Project Landscape Architect.

4. Construction Exit Removal: Construction exit(s) shall be removed and properly disposed of when the disturbed area has been properly stabilized, the tracking or flow of soil onto public rights-of-way or paved surfaces has ceased and as directed by the Project Landscape Architect.

B. Sediment Barriers:

1. Sediment barriers shall include, but are not necessarily limited to, silt fences, hay bales, and any device which prevents sediment from exiting the disturbed area.

2. Silt fences and hay bales shall not be used in any flowing stream, creek, or river.

3. Sediment barriers shall be installed as shown on the Drawings and as directed by the Owner or Project Landscape Architect.

4. Sediment barriers shall be maintained to ensure the depth of impounded sediment is no more than one-half of the original height of the barrier or as directed by the Project Landscape Architect. Torn, damaged, destroyed, or washed-out barriers shall be repaired, reinforced, or replaced with new

material and installed as shown on the Drawings and as directed by the Owner or Project Landscape Architect.

5. Sediment Barrier Removal:

   a. Sediment barrier shall be removed once the disturbed area has been stabilized with a permanent vegetative cover and the sediment barrier is no longer required as directed by the Project Landscape Architect.

   b. Accumulated sediment shall be removed from the barrier and replaced and stabilized on-site as directed by the Owner or Project Landscape Architect.

   c. All non-biodegradable parts of the barrier shall be disposed of properly.

   d. The disturbed area created by barrier removal shall be permanently stabilized.

C. Sediment Boxes: All inlet grates shall be covered with sediment boxes during grading operations and shall remain so covered until all open areas are permanently stabilized against erosion.

3.03 Erosion Control

A. Rip Rap

1. Rip rap shall be placed as shown on the Drawings and as directed by the Project Landscape Architect. Rip rap shall be placed at all points where natural vegetation is disturbed on the banks of active streams. Compact backfill and place rip rap to prevent subsequent settlement and erosion. This requirement applies equally to construction alongside a stream as well as crossing a stream or drainage ditch.

2. When trenching across a stream or drainage ditch, place rip rap over the entire disturbed area upstream and downstream of the trench excavation. Place rip rap across creek bottom, across creek banks, and extend rip rap placement five feet beyond the top of each creek bank.

3. Preparation of Foundations: The ground surface upon which the rip rap is to be placed shall be brought to the correct lines and grades before placement is commenced. Where filling of depressions is required, the new material shall be compacted with hand or mechanical tampers. Unless at creek banks or otherwise shown or specified, rip rap shall begin in a toe ditch constructed in original ground around the toe of the fill or the cut slope. The toe ditch shall be two feet deep in original ground, and the side next to the fill or cut shall have that same slope. After the rip rap is placed, the toe ditch shall be backfilled and the excess dirt spread neatly on the site.

4. Placement of Plastic Filter Fabric:

a. Plastic filter fabric shall be placed under all rip rap unless shown or specified otherwise.

b. Filter fabric shall not be placed under rip rap on stream or drainage ditch crossings.

c. The surface to receive filter fabric shall be prepared to a smooth condition free from obstructions, depressions, and debris. The filter fabric shall be installed with the long dimension running up the slope and shall be placed to provide a minimum number of overlaps. The fabric shall be placed to provide a minimum width of one foot of overlap at each joint. The fabric shall be placed so that the upstream strip overlaps the downstream strip. The fabric shall be anchored in place with securing pins of the type recommended by the fabric manufacturer. Pins shall be placed on or within 3-inches of the centerline of the overlap. The fabric shall be placed loosely to avoid stretching and tearing during placement of the stone. The fabric shall be protected at all times during construction from clogging due to clay, silts, chemicals, or other contaminants. Contaminated fabric or fabric damaged during installation or during placement of rip rap shall be removed and replaced with uncontaminated and undamaged fabric at no additional cost to the Owner.

5. Placement of Rip Rap: Rip rap shall be placed on a 6-inch layer of soil, crushed stone or sand overlaying the filter fabric. Rip rap shall be placed with its top elevation conforming with the finished grade or the natural existing slope of the stream bank and stream bottom. The stone shall be dropped from no more than a three foot height during construction. Stone rip rap shall be placed to provide a uniform surface to the thickness shown on the Drawings. The thickness tolerance for the course shall be –3 inches and +6 inches.

B. Grassing:

1. Grassing shall meet the requirements of Section 700 of the Georgia Department of Transportation Standard Specifications, latest edition, unless specified otherwise.

2. Seed rate, fertilization and other requirements shall be provided as shown on the Drawings.

3. Temporary Stabilization: Temporary stabilization shall be provided as shown on the Drawings and conforming to these Specifications to control erosion on the site. Temporary stabilization shall be provided to any area that will not receive permanent stabilization within the next 14 calendar days. Partial payment requests may be withheld for those portions of the Project not complying with this requirement.

4. Permanent Stabilization:

a. Permanent stabilization shall be provided as shown on the Drawings and conforming to these Specifications to control erosion on the site.

Permanent stabilization shall be provided to all areas of land disturbance within seven calendar days of the completion of land disturbance for any area greater than 0.25 acre.

b. Where permanent stabilization cannot be immediately established because of an inappropriate season, the Contractor shall provide temporary stabilization. The Contractor shall return to the site at the appropriate season to provide permanent stabilization in areas that received only temporary stabilization.

3.04 Clean-Up

A. Dispose of all excess erosion and sedimentation control materials in a manner satisfactory to the Owner and Landscape Architect.

B. Final clean-up shall be performed in accordance with the requirements of these Specifications and to the satisfaction of the Owner and Landscape Architect.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Cold milling of existing hot-mix asphalt pavement.
2. Hot-mix asphalt patching.
3. Hot-mix asphalt paving.
4. Hot-mix asphalt paving overlay.
5. Asphalt surface treatments.
6. Pavement-marking paint.
7. Traffic-calming devices.
8. Imprinted asphalt.

B. Related Sections:

1. Division 02 Section "Structure Demolition" for demolition, removal, and recycling of existing asphalt pavements, and for geotextiles that are not embedded within courses of asphalt paving.
2. Division 2 Section "Earth Moving" for aggregate subbase and base courses and for aggregate pavement shoulders.
3. Division 3 Section "Concrete Paving Joint Sealants" for joint sealants and fillers at paving terminations.

1.3 UNIT PRICES

A. Work of this Section is affected by unit price.

1.4 DEFINITION

A. Hot-Mix Asphalt Paving Terminology: Refer to ASTM D 8 for definitions of terms.

1.5 SUBMITTALS

A. Product Data: For each type of product indicated. Include technical data and tested physical and performance properties.

1. Job-Mix Designs: Certification, by authorities having jurisdiction, of approval of each job mix proposed for the Work.
2. Job-Mix Designs: For each job mix proposed for the Work.

B. Shop Drawings: Indicate pavement markings, lane separations, and defined parking spaces. Indicate, with international symbol of accessibility, spaces allocated for people with disabilities.

C. Samples: For each paving fabric, 12 by 12 inches (300 by 300 mm) minimum.

D. Samples for Verification: For the following products, in manufacturer's standard sizes unless otherwise indicated:

1. Each paving fabric, 12 by 12 inches (300 by 300 mm) minimum.
2. Each type and color of preformed traffic-calming device.

E. Qualification Data: For qualified manufacturer and Installer.

F. Material Certificates: For each paving material, from manufacturer.

G. Material Test Reports: For each paving material.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: A paving-mix manufacturer registered with and approved by authorities having jurisdiction.

B. Installer Qualifications: Imprinted-asphalt manufacturer's authorized installer who is trained and approved for installation of imprinted asphalt required for this Project.

C. Testing Agency Qualifications: Qualified according to ASTM D 3666 for testing indicated.

D. Regulatory Requirements: Comply with materials, workmanship, and other applicable requirements of Clayton County for asphalt paving work.

1. Measurement and payment provisions and safety program submittals included in standard specifications do not apply to this Section.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver pavement-marking materials to Project site in original packages with seals unbroken and bearing manufacturer's labels containing brand name and type of material, date of manufacture, and directions for storage.

B. Store pavement-marking materials in a clean, dry, protected location within temperature range required by manufacturer. Protect stored materials from direct sunlight.

1.8 PROJECT CONDITIONS

A. Environmental Limitations: Do not apply asphalt materials if subgrade is wet or excessively damp, if rain is imminent or expected before time required for adequate cure, or if the following conditions are not met:

1. Prime Coat: Minimum surface temperature of 60 deg F (15.6 deg C).
2. Tack Coat: Minimum surface temperature of 60 deg F (15.6 deg C).
3. Slurry Coat: Comply with weather limitations in ASTM D 3910.

4. Asphalt Base Course: Minimum surface temperature of 40 deg F (4.4 deg C) and rising at time of placement.
5. Asphalt Surface Course: Minimum surface temperature of 60 deg F (15.6 deg C) at time of placement.

B. Pavement-Marking Paint: Proceed with pavement marking only on clean, dry surfaces and at a minimum ambient or surface temperature of 55 deg F (12.8 deg C) for water-based materials, and not exceeding 95 deg F (35 deg C).

C. Imprinted Asphalt Paving: Proceed with coating imprinted pavement only when air temperature is at least 50 deg F (10 deg C) and rising and will not drop below 50 deg F (10 deg C) within 8 hours of coating application. Proceed only if no precipitation is expected within two hours after applying the final layer of coating.

PART 2 - PRODUCTS

2.1 AGGREGATES

A. General: Use materials and gradations that have performed satisfactorily in previous installations.

B. Coarse Aggregate: ASTM D 692, sound; angular crushed stone, crushed gravel, or cured, crushed blast-furnace slag.

C. Fine Aggregate: ASTM D 1073, sharp-edged natural sand or sand prepared from stone, gravel, cured blast-furnace slag, or combinations thereof.

1. For hot-mix asphalt, limit natural sand to a maximum of 20 percent by weight of the total aggregate mass.

D. Mineral Filler: ASTM D 242 or AASHTO M 17, rock or slag dust, hydraulic cement, or other inert material.

2.2 ASPHALT MATERIALS

A. Asphalt Binder: AASHTO M 320.

B. Asphalt Cement: ASTM D 3381 for viscosity-graded material.

C. Prime Coat: ASTM D 2027, medium-curing cutback asphalt.

D. Prime Coat: Asphalt emulsion prime coat complying with Local AHJ requirements and the Georgia Department of Transportation.

E. Tack Coat: ASTM D 977 or AASHTO M 140 emulsified asphalt, or ASTM D 2397 or AASHTO M 208 cationic emulsified asphalt, slow setting, diluted in water, of suitable grade and consistency for application.

F. Fog Seal: ASTM D 977 or AASHTO M 140 emulsified asphalt, or ASTM D 2397 or AASHTO M 208 cationic emulsified asphalt, slow setting, factory diluted in water, of suitable grade and consistency for application.

G. Water: Potable.

H. Undersealing Asphalt: ASTM D 3141, pumping consistency.

2.3 AUXILIARY MATERIALS

A. Herbicide: Commercial chemical for weed control, registered by the EPA. Provide in granular, liquid, or wettable powder form.

B. Sand: ASTM D 1073 or AASHTO M 29, Grade Nos. 2 or 3.

C. Paving Geotextile: AASHTO M 288, nonwoven polypropylene; resistant to chemical attack, rot, and mildew; and specifically designed for paving applications.

D. Joint Sealant: ASTM D 6690, hot-applied, single-component, polymer-modified bituminous sealant.

E. Pavement-Marking Paint: Alkyd-resin type, lead and chromate free, ready mixed, complying with AASHTO M 248; colors complying with FS TT-P-1952.

1. Color: White

F. Wheel Stops: Precast, air-entrained concrete, 2500-psi (17.2-MPa) minimum compressive strength, [4-1/2 inches (115 mm) high by 9 inches (225 mm) wide by 72 inches (1800 mm) . Provide chamfered corners, drainage slots on underside, and holes for anchoring to substrate.

1. Dowels: Galvanized steel, 3/4-inch (19-mm) diameter, 10-inch (254-mm) minimum length.

2.4 MIXES

A. Hot-Mix Asphalt: Dense, hot-laid, hot-mix asphalt plant mixes approved by authorities having jurisdiction designed according to procedures in GDOT's current standards and complying with the following requirements:

1. Provide mixes with a history of satisfactory performance in geographical area where Project is located.
2. Base Course: Georgia D.O.T. Base – Section 310
3. Wear Course: Georgia D.O.T. Wear Course – Section 400

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that subgrade is dry and in suitable condition to begin paving.

B Proof-roll subgrade below pavements with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.

1. Completely proof-roll subgrade in one direction repeating proof-rolling in direction perpendicular to first direction. Limit vehicle speed to 3 mph (5 km/h).

2. Proof roll with a loaded 10-wheel, tandem-axle dump truck weighing not less than 15 tons (13.6 tonnes).
3. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Architect, and replace with compacted backfill or fill as directed.

C. Proceed with paving only after unsatisfactory conditions have been corrected.

D. Verify that utilities, traffic loop detectors, and other items requiring a cut and installation beneath the asphalt surface have been completed and that asphalt surface has been repaired flush with adjacent asphalt prior to beginning installation of imprinted asphalt.

3.2 PATCHING

A. Hot-Mix Asphalt Pavement: Saw cut perimeter of patch and excavate existing pavement section to sound base. Excavate rectangular or trapezoidal patches, extending 12 inches (300 mm) into adjacent sound pavement, unless otherwise indicated. Cut excavation faces vertically. Remove excavated material. Recompact existing unbound-aggregate base course to form new subgrade.

B. Portland Cement Concrete Pavement: Break cracked slabs and roll as required to reseat concrete pieces firmly.

1. Pump hot undersealing asphalt under rocking slab until slab is stabilized or, if necessary, crack slab into pieces and roll to reseat pieces firmly.
2. Remove disintegrated or badly cracked pavement. Excavate rectangular or trapezoidal patches, extending into adjacent sound pavement, unless otherwise indicated. Cut excavation faces vertically. Recompact existing unbound-aggregate base course to form new subgrade.

C. Tack Coat: Apply uniformly to vertical surfaces abutting or projecting into new, hot-mix asphalt paving at a rate of 0.05 to 0.15 gal./sq. yd. (0.2 to 0.7 L/sq. m).

1. Allow tack coat to cure undisturbed before applying hot-mix asphalt paving.
2. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.

D. Patching: Fill excavated pavements with hot-mix asphalt base mix for full thickness of patch and, while still hot, compact flush with adjacent surface.

E. Patching: Partially fill excavated pavements with hot-mix asphalt base mix and, while still hot, compact. Cover asphalt base course with compacted, hot-mix surface layer finished flush with adjacent surfaces.

3.3 REPAIRS

A Leveling Course: Install and compact leveling course consisting of hot-mix asphalt surface course to level sags and fill depressions deeper than 1 inch (25 mm) in existing pavements.

1. Install leveling wedges in compacted lifts not exceeding 3 inches (75 mm) thick.

B. Crack and Joint Filling: Remove existing joint filler material from cracks or joints to a depth of 1/4 inch (6 mm).

1. Clean cracks and joints in existing hot-mix asphalt pavement.
2. Use emulsified-asphalt slurry to seal cracks and joints less than 1/4 inch (6 mm) wide. Fill flush with surface of existing pavement and remove excess.
3. Use hot-applied joint sealant to seal cracks and joints more than 1/4 inch (6 mm) wide. Fill flush with surface of existing pavement and remove excess.

3.4 SURFACE PREPARATION

A. General: Immediately before placing asphalt materials, remove loose and deleterious material from substrate surfaces. Ensure that prepared subgrade is ready to receive paving.

B. Herbicide Treatment: Apply herbicide according to manufacturer's recommended rates and written application instructions. Apply to dry, prepared subgrade or surface of compacted-aggregate base before applying paving materials.

1. Mix herbicide with prime coat if formulated by manufacturer for that purpose.

C. Prime Coat: Apply uniformly over surface of compacted unbound-aggregate base course at a rate of 0.15 to 0.50 gal./sq. yd. (0.7 to 2.3 L/sq. m). Apply enough material to penetrate and seal but not flood surface. Allow prime coat to cure.

1. If prime coat is not entirely absorbed within 24 hours after application, spread sand over surface to blot excess asphalt. Use enough sand to prevent pickup under traffic. Remove loose sand by sweeping before pavement is placed and after volatiles have evaporated.
2. Protect primed substrate from damage until ready to receive paving.

D. Tack Coat: Apply uniformly to surfaces of existing pavement at a rate of 0.05 to 0.15 gal./sq. yd. (0.2 to 0.7 L/sq. m).

1. Allow tack coat to cure undisturbed before applying hot-mix asphalt paving.
2. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.

3.5 HOT-MIX ASPHALT PLACING

A. Machine place hot-mix asphalt on prepared surface, spread uniformly, and strike off. Place asphalt mix by hand to areas inaccessible to equipment in a manner that prevents segregation of mix. Place each course to required grade, cross section, and thickness when compacted.

1. Place hot-mix asphalt base course in number of lifts and thicknesses indicated.
2. Place hot-mix asphalt surface course in single lift.
3. Spread mix at minimum temperature of 250 deg F (121 deg C).
4. Begin applying mix along centerline of crown for crowned sections and on high side of one-way slopes unless otherwise indicated.
5. Regulate paver machine speed to obtain smooth, continuous surface free of pulls and tears in asphalt-paving mat.

B. Place paving in consecutive strips not less than 10 feet (3 m) wide unless infill edge strips of a lesser width are required.

1. After first strip has been placed and rolled, place succeeding strips and extend rolling to overlap previous strips. Complete a section of asphalt base course before placing asphalt surface course.

C. Promptly correct surface irregularities in paving course behind paver. Use suitable hand tools to remove excess material forming high spots. Fill depressions with hot-mix asphalt to prevent segregation of mix; use suitable hand tools to smooth surface.

3.6 JOINTS

A. Construct joints to ensure a continuous bond between adjoining paving sections. Construct joints free of depressions, with same texture and smoothness as other sections of hot-mix asphalt course.

1. Clean contact surfaces and apply tack coat to joints.
2. Offset longitudinal joints, in successive courses, a minimum of 6 inches (150 mm).
3. Offset transverse joints, in successive courses, a minimum of 24 inches (600 mm).
4. Construct transverse joints at each point where paver ends a day's work and resumes work at a subsequent time. Construct these joints using either "bulkhead" or "papered" method according to AI MS-22, for both "Ending a Lane" and "Resumption of Paving Operations." Compact joints as soon as hot-mix asphalt will bear roller weight without excessive displacement.
5. Compact asphalt at joints to a density within 2 percent of specified course density.

3.7 COMPACTION

A. General: Begin compaction as soon as placed hot-mix paving will bear roller weight without excessive displacement. Compact hot-mix paving with hot, hand tampers or with vibratory-plate compactors in areas inaccessible to rollers.

1. Complete compaction before mix temperature cools to 185 deg F (85 deg C).

B. Breakdown Rolling: Complete breakdown or initial rolling immediately after rolling joints and outside edge. Examine surface immediately after breakdown rolling for indicated crown, grade, and smoothness. Correct laydown and rolling operations to comply with requirements.

C. Intermediate Rolling: Begin intermediate rolling immediately after breakdown rolling while hot-mix asphalt is still hot enough to achieve specified density. Continue rolling until hot-mix asphalt course has been uniformly compacted to the following density:

1. Average Density: 96 percent of reference laboratory density according to ASTM D 6927, but not less than 94 percent nor greater than 100 percent.
2. Average Density: 92 percent of reference maximum theoretical density according to ASTM D 2041, but not less than 90 percent nor greater than 96 percent.

D. Finish Rolling: Finish roll paved surfaces to remove roller marks while hot-mix asphalt is still warm.

E. Edge Shaping: While surface is being compacted and finished, trim edges of pavement to proper alignment. Bevel edges while asphalt is still hot; compact thoroughly.

F. Repairs: Remove paved areas that are defective or contaminated with foreign materials and replace with fresh, hot-mix asphalt. Compact by rolling to specified density and surface smoothness.

G. Protection: After final rolling, do not permit vehicular traffic on pavement until it has cooled and hardened.

H. Erect barricades to protect paving from traffic until mixture has cooled enough not to become marked.

3.8 ASPHALT CURBS

A. Construct hot-mix asphalt curbs over compacted pavement surfaces. Apply a light tack coat unless pavement surface is still tacky and free from dust. Spread mix at minimum temperature of 250 deg F (121 deg C).

1. Asphalt Mix: Same as pavement surface-course mix.

B. Place hot-mix asphalt to curb cross section indicated or, if not indicated, to local standard shapes, by machine or by hand in wood or metal forms. Tamp hand-placed materials and screed to smooth finish. Remove forms after hot-mix asphalt has cooled.

3.9 INSTALLATION TOLERANCES

A. Pavement Thickness: Compact each course to produce the thickness indicated within the following tolerances:

1. Base Course: Plus or minus 1/2 inch (13 mm).
2. Surface Course: Plus 1/4 inch (6 mm), no minus.

B. Pavement Surface Smoothness: Compact each course to produce a surface smoothness within the following tolerances as determined by using a 10-foot (3-m) straightedge applied transversely or longitudinally to paved areas:

1. Base Course: 1/4 inch (6 mm)
2. Surface Course: 1/8 inch (3 mm).
3. Crowned Surfaces: Test with crowned template centered and at right angle to crown. Maximum allowable variance from template is 1/4 inch (6 mm).

3.10 SURFACE TREATMENTS

A. Fog Seals: Apply fog seal at a rate of 0.10 to 0.15 gal./sq. yd. (0.45 to 0.7 L/sq. m) to existing asphalt pavement and allow to cure. With fine sand, lightly dust areas receiving excess fog seal.

B. Slurry Seals: Apply slurry coat in a uniform thickness according to ASTM D 3910 and allow to cure.

1. Roll slurry seal to remove ridges and provide a uniform, smooth surface.

3.11 PAVEMENT MARKING

A. Do not apply pavement-marking paint until layout, colors, and placement have been verified with Architect.

B. Allow paving to age for 30 days before starting pavement marking.

C. Sweep and clean surface to eliminate loose material and dust.

D. Apply paint with mechanical equipment to produce pavement markings, of dimensions indicated, with uniform, straight edges. Apply at manufacturer's recommended rates to provide a minimum wet film thickness of 15 mils (0.4 mm).

1. Broadcast glass beads uniformly into wet pavement markings at a rate of 6 lb/gal. (0.72 kg/L).

3.12 WHEEL STOPS

A. Install wheel stops in bed of adhesive as recommended by manufacturer.

B. Securely attach wheel stops to pavement with not less than two galvanized-steel dowels embedded at one-quarter to one-third points. Securely install dowels into pavement and bond to wheel stop. Recess head of dowel beneath top of wheel stop.

3.13 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Thickness: In-place compacted thickness of hot-mix asphalt courses will be determined according to ASTM D 3549.

C. Surface Smoothness: Finished surface of each hot-mix asphalt course will be tested for compliance with smoothness tolerances.

D. In-Place Density: Testing agency will take samples of uncompacted paving mixtures and compacted pavement according to ASTM D 979.

1. Reference maximum theoretical density will be determined by averaging results from four samples of hot-mix asphalt-paving mixture delivered daily to site, prepared according to ASTM D 2041, and compacted according to job-mix specifications.
2. In-place density of compacted pavement will be determined by testing core samples according to ASTM D 1188 or ASTM D 2726.

    a. One core sample will be taken for every 1000 sq. yd. (836 sq. m) or less of installed pavement, with no fewer than 3 cores taken.
    b. Field density of in-place compacted pavement may also be determined by nuclear method according to ASTM D 2950 and correlated with ASTM D 1188 or ASTM D 2726.

E. Replace and compact hot-mix asphalt where core tests were taken.

F. Remove and replace or install additional hot-mix asphalt where test results or measurements indicate that it does not comply with specified requirements.

3.14 DISPOSAL

A. Except for material indicated to be recycled, remove excavated materials from Project site and legally dispose of them in an EPA-approved landfill.

1. Do not allow milled materials to accumulate on-site.

END OF SECTION

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 soil treatment for termite control.

1.3 SUBMITTALS

A. General: Submit the following according to Conditions of Contract and Division 1 Specification Sections.

B. Product data and application instructions.

C. Certification that products used comply with U.S. Environmental Protection Agency (EPA) regulations for termiticides.

1.4 QUALITY ASSURANCE

A. In addition to requirements of these specifications, comply with manufacturer's instructions and recommendations for preparing substrate and application.

B. Engage a professional pest control operator who is licensed according to regulations of governing authorities to apply soil treatment solution.

C. Use only termiticides that bear a federal registration number of the EPA and are approved by local authorities having jurisdiction.

1.5 JOB CONDITIONS

A. Restrictions: Do not apply soil treatment solution until excavating, filling, and grading operations are completed, except as otherwise required in construction operations.

B. To ensure penetration, do not apply soil treatment to frozen or excessively wet soils or during inclement weather. Comply with handling and application instructions of the soil toxicant manufacturer.

1.6 WARRANTY

A. Warranty: Furnish written warranty, executed by Applicator and Contractor, certifying that applied soil termiticide treatment will prevent infestation of subterranean termites. If subterranean termite activity is discovered during warranty period, Contractor will re-treat soil and repair or replace damage caused by termite infestation.

B. Warranty Period: 5 years from date of Substantial Completion.

C. The warranty shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and will be in addition to and run concurrent with other warranties made by the Contractor under requirements of the Contract Documents.

PART 2 - PRODUCTS

2.1 SOIL TREATMENT SOLUTION

A. General: Use an emulsible, concentrated termiticide that dilutes with water, specially formulated to prevent termites infestation. Fuel oil will not be permitted as a diluent. Provide a solution consisting of one of following chemical elements.

B. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the following:

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

1. Chloropyrifos:

    a. Dursban TC, Dow Chemical Co.

2. Permathrin:

    a. Dragnet FT, FMC Corp.
    b. Torpedo, ICI Americas, Inc.

3. Cypermethrine:

    a. Prevail FT, FMC Corp.
    b. Demon, ICI Americas, Inc.

4. Fenvalerate:

    a. Gold Coast Tribute, Du Pont.

5. Isofenphose:

    a. Pryfon, Mobay Corp.

D. Dilute with water to concentration level recommended by manufacturer.

E. Other solutions may be used as recommended by Applicator if approved for intended application by local authorities having jurisdiction. Use only soil treatment solutions that are not harmful to plants.

PART 3 - EXECUTION

3.1 APPLICATION

A. Surface Preparation: Remove foreign matter that could decrease treatment effectiveness on areas to be treated. Loosen, rake, and level soil to be treated, except previously compacted areas under slabs and foundations. Toxicants may be applied before placing compacted fill under slabs if recommended by toxicant manufacturer.

B. Application Rates: Apply soil treatment solution as follows:

1. Under slab-on-grade structures, treat soil before concrete slabs are placed, using the following application rates:

    a. Apply 4 gallons of chemical solution per 10 linear feet (5.1 L of chemical solution per meter) to soil in critical areas under slab, including entire inside perimeter of foundation walls, along both sides of interior partition walls, around plumbing pipes and electric conduit penetrating slab, and around interior column footers.
    b. Apply 1 gallon of chemical solution per 10 sq. ft. (4.1 L of chemical solution per sq. m) as an overall treatment under slab and attached slab areas where fill is soil or unwashed gravel. Apply 1-1/2 gallon of chemical solution per 10 sq. ft. (6.1 L of chemical solution per sq. m) to areas where fill is washed gravel or other coarse absorbent material.
    c. Apply 4 gallons of chemical solution per 10 linear feet (5.1 L of chemical solution per meter) of trench for each 12 inches (300 mm) of depth from grade to footing, along outside edge of building. Dig a trench 6 to 8 inches (150 to 200 mm) wide along outside of foundation to a depth of not less than 12 inches (300 mm). Punch holes to top of footing at not more than 12 inches (300 mm) o.c. and apply chemical solution. Mix chemical solution with the soil as it is being replaced in the trench.

2. Under crawlspace and basement structures, treat soil along exterior and interior walls of foundations with shallow footings as specified above for exterior of slab-on-grade structures.
3. Treat soil under or around crawlspace structures as follows:

    a. Apply 4 gallons of chemical solution per 10 linear feet (5.1 L of chemical solution per meter) of trench along inside of foundation walls, along both sides of interior partitions, and around piers and plumbing. Do not apply an overall treatment in crawlspaces.
    b. Apply 4 gallons of chemical solution per 10 linear feet (5.1 L of chemical solution per meter) of trench, for each 12 inches (300 mm) of depth from grade to footing, along outside of foundation walls, including part beneath entrance platform porches, etc.
    c. Apply 4 gallons of chemical solution per 10 linear feet (5.1 L of chemical solution per meter) along the inside and outside of foundation walls of porches.
    d. Apply 1 gallon of chemical solution per 10 sq. ft. (4.1 L of chemical solution per sq. m) of soil surface as an overall treatment only where attached concrete platform and porches are on fill or ground.

4. At hollow masonry foundations or grade beams, treat voids at rate of 2 gallons per 10 linear feet 2.6 L per meter, poured directly into the hollow spaces.
5. At expansion joints, control joints, and areas where slabs will be penetrated, apply at rate of 4 gallons per 10 linear feet (5.1 L per linear m) of penetration.

C. Post signs in areas of application to warn workers that soil termiticide treatment has been applied. Remove signs after areas are covered by other construction.

D. Reapply soil treatment solution to areas disturbed by subsequent excavation, landscape grading, or other construction activities following application.

END OF SECTION

PART 1 - GENERAL

1.01 DESCRIPTION

A. Scope of Work
   1. This Section specifies the labor, materials, equipment, and incidentals required for the demolition, relocation, and/or disposal of all structures, building materials, equipment, and accessories to be removed as shown on the Drawings and as specified herein.
   2. There may be existing and active stormwater, wastewater, water, and other facilities on site as indicated on the Drawings. It is essential that these facilities, when encountered, remain intact and in service during the proposed demolition. Consequently, the Contractor shall be responsible for the protection of these facilities and shall diligently direct all his activities toward maintaining continuous operation of the existing facilities and minimizing operational inconvenience.
   3. Demolition generally includes:
      a. Complete demolition and removal of manholes, valve vaults, wetwells, piping, and mechanical and electrical equipment related to the Work as shown on the Drawings and specified herein.
      b. Complete demolition and removal of all above and below ground structures, concrete slabs and foundations, vaults, and underground utilities (water, wastewater, electrical, etc.) as shown on the Drawings and specified herein.
      c. All material, equipment, rubble, debris, and other products of the demolition shall become the property of the Contractor for his disposal off-site in accordance with all applicable laws and ordinances at the Contractor's expense. The sale of salvageable materials by the Contractor shall only be conducted off-site. The sale of removed items on the site is prohibited by the City.
   4. The Contractor shall examine the various Drawings, visit the site, determine the extent of the Work, the extent of work affected therein, and all conditions under which he is required to perform the various operations.
   5. The Contractor shall fill and compact all voids left by the removal of pipe, structures, etc. with materials described herein to a grade that will provide for positive drainage of the disturbed area to drain run-off in direction consistent with the surrounding area. The Contractor shall provide all fill materials to the site as needed. Compaction of fill shall match the compaction of adjacent undisturbed material.

1.02 QUALITY ASSURANCE

A. Permits and Licenses: Contractor shall obtain all necessary permits and licenses for performing the Work and shall furnish a copy of same to the Owner/Architect prior to commencing the Work. The Contractor shall comply with the requirements of the permits.

B. Notices: Contractor shall issue written notices of planned demolition to companies or local authorities owning utility conduit, wires, or pipes running to or through the project site. Copies of said notices shall be submitted to the City.

C. Utility Services: Contractor shall notify utility companies or local authorities furnishing gas, water, electrical, telephone, or sewer service to remove any equipment in the structures to be demolished and to remove, disconnect, cap, or plug their services to facilitate demolition.

D. Contractor shall notify the AHJ in writing prior to beginning any demolition work.

1.03 SHOP DRAWINGS AND SUBMITTALS

A. Submittals shall be submitted to the Architect/Owners Representative for review and acceptance prior to construction in accordance with the General Conditions and specifications section for "Submittals."

B. Submit to the Architect/Owners Representative for their approval, 2 copies of proposed methods and operations of demolition or relocation of the structures specified below prior to the start of Work. Include in the schedule the coordination of shut-off, capping, and continuation of utility service as required.

C. Provide a detailed sequence of demolition and removal work.

D. The above procedure must be followed for each individual demolition operation.

1.04 SITE CONDITIONS

A. Prior to demolition, the Contractor shall obtain written verification from the utility owner(s) that the existing utilities, including stormwater, wastewater, and/or water facilities, are not operational and are ready for demolition.

B. The Owner assumes no responsibility for the actual condition of the structures to be demolished or relocated.

C. Conditions existing at the time of inspection for bidding purposes will be maintained by the Owner insofar as practicable. However, variations within each site may occur prior to the start of demolition work.

D. No additional payment will be made for pumping or other difficulties encountered due to water.

E. Certain information regarding the reputed presence, size, character and location of existing underground structures, pipes and conduit has been shown on the Drawings. There is no certainty of the accuracy of this information, and the location of underground structures shown may be inaccurate and other obstructions than those shown may be encountered. The Contractor hereby distinctly agrees that the Owner is not responsible for the correctness or sufficiency of the information given; that in no event is this information to be considered as a part of the Contract; that he shall have no claim for delay or extra compensation on account of incorrectness of information regarding obstructions either revealed or not revealed by the Drawings; and that he shall have no claim for relief from any obligation or responsibility under this Contract in case the location, size, or character of any pipe or other underground structure is not as indicated on the Drawings, or in case any pipe or other underground structure is encountered that is not shown on the Drawings.

1.05 RESTRICTIONS

A. No building, tank or structure, or any part thereof, shall be demolished until an application has been filed by the Contractor with the AHJ and a permit issued if a permit is required. The fee for this permit shall be the Contractor's responsibility. Demolition shall be in accordance with

applicable provisions of the International Building Code.

B. No explosives shall be used at any time during the demolition. No burning of combustible material will be allowed.

C. Contractor shall notify the AHJ prior to beginning any demolition work.

1.06 DISPOSAL OF MATERIAL

A. All salvageable or useable material or equipment to be retained by the Owner shall be shown on Drawings, and shall be moved to a designated area by Contractor for pick up by Owner. The Contractor shall promptly remove all other materials from the site as indicated or shown on the Drawings.

B. All materials not retained by the Owner shall become the Contractor's property and shall be removed off-site.

C. The on-site storage of removed items is prohibited by the Owner. Off-site sale of salvageable material by the Contractor is acceptable.

1.07 TRAFFIC AND ACCESS

A. Conduct work to ensure minimum interference with on-site and off-site roads, streets, sidewalks, and occupied or used facilities.

B. Special attention is directed towards maintaining safe and convenient access to the existing facilities remaining in operation by plant personnel and plant associated vehicles, including trucks and delivery vehicles.

C. Do not close or obstruct streets, sidewalks, or other occupied or used facilities without permission from the AHJ. Provide alternate routes around closed or obstructed traffic in access ways.

1.08 PROTECTION

A. Conduct operations to minimize damage by falling debris or other causes to adjacent buildings, structures, roadways, other facilities, and persons. Provide interior and exterior shoring, bracing, or support to prevent movement or settlement or collapse of structures to be demolished and adjacent facilities to remain.

1.09 DAMAGE

A. Promptly repair damage caused to adjacent facilities by demolition operations as directed by the AHJ at no cost to the Owner.

1.10 UTILITIES

A. Maintain existing utilities as directed by the AHJ to remain in service and protect against damage during demolition operations.

B. Do not interrupt existing utilities serving occupied or operational facilities, except when authorized by Owner. Provide temporary services during interruptions to existing utilities as acceptable to the Owner.

C. The Contractor shall cooperate with the AHJ to shut off utilities serving structures of the existing facilities as required by demolition operations.

D. The Contractor shall be solely responsible for making all necessary arrangements and for performing any necessary work involved in connection with the interruption of all public and private utilities or services.

E. All utilities being abandoned shall be terminated at the service mains in conformance with the requirement of the utility companies or the municipality owning or controlling them.

1.11 EXTERMINATION

A. If required, before starting demolition, the Contractor shall employ a certified rodent and vermin exterminator and treat the facilities in accordance with governing health laws and regulations. Any rodents, insects, or other vermin appearing before or during the demolition shall be killed or otherwise prevented from leaving the immediate vicinity of the demolition work.

1.12 POLLUTION CONTROL

A. For pollution control, use water sprinkling, temporary enclosures, and other suitable methods as necessary to limit the amount of dust rising and scattering in the air to the lowest level of air pollution practical for the conditions of work. The Contractor shall comply with the governing regulations.

B. Remove of any hazardous materials shall comply with the governing regulations.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.01 SEQUENCE OF WORK

A. The sequence of demolition shall be in accordance with the approved critical path schedule as specified in paragraph 1.03 above.

3.02 REMOVAL OF EXISTING PROCESS EQUIPMENT, PIPING, AND APPURTENANCES

A. Equipment to be retained by the Owner will be designated for retention by the Owner prior to bidding as specified in Paragraph 1.06 above. All other process equipment, non-buried valving and piping, and appurtenances shall be removed from the site.

3.03 DEMOLITION PROCEDURES

The Contractor shall adhere to the following demolition procedures as referenced on the Drawings:

A. TO BE DEMOLISHED: Demolition shall be the breaking up, cutting, filling of any holes resulting, final grading of the area, performing any other operations required, and the removal from the site of all structures and equipment (structures, substructures, floor slabs, equipment, tanks, pipes, fittings, electrical systems, light poles, wiring, underground conduits and wiring, isolated slabs, and sidewalks) as indicated on the Drawings. All pieces of concrete, metal, and any other demolished material shall be removed to a depth of at least 5-feet below existing grade. Broken pieces of concrete may be size reduced by an on-site crusher, but in any event must be removed from the project site.

   Before commencing structural demolition, remove all mechanical, electrical, piping, and miscellaneous appurtenances. Completely remove the structure by thoroughly breaking up concrete into pieces no more than 2-feet across the largest dimension.

B. TO BE REMOVED: Where indicated on the Drawings, the structures and equipment shall be completely removed from the site with all associated connecting piping or electrical service. The item shall be taken whole or in parts to be salvaged or disposed of by the Contractor.

C. TO BE ABANDONED: Where indicated on the Drawings, the structures and equipment shall be left in place, drained, and the contents properly disposed. The upper 4-feet of the structure shall be cut and removed, including the cover slab and access port, frame, and cover. All structures to be abandoned with bottom slabs shall be drilled (2 holes minimum, 2.0-inch diameter each) or hole punched to prevent flotation and filled with common fill.

D. PIPING TO BE REMOVED: Where indicated on the Drawings, pipe (and conduit) shall be drained and the contents properly disposed. The pipe (or conduit) shall then be completely removed from the site, including fittings, valves, and other in-line devices. Connections to existing piping to remain shall be plugged by mechanical means (M.J. plugs, tie-rods, or thrust blocks). Piping shall be removed in accordance with Specification Section 02080 "Abandonment, Removal and Salvage or Disposal of Existing Pipe."

E. PIPING TO BE ABANDONED: Where indicated on the Drawings, piping (or conduit) shall be left in place. All such piping shall be drained and the contents properly disposed. The pipe (or conduit) shall then be filled with grout (flowable fill) and each end of the pipe (or conduit) shall be plugged using a concrete plug in a manner acceptable to the City. Piping shall be abandoned in accordance with Specification Section 02080 "Abandonment, Removal and Salvage or Disposal of Existing Pipe."

F. TO BE PROTECTED: Where indicated on the Drawings, the utility service, fence, structure, tree, or device so designated shall be temporarily protected during the prosecution of the demolition work as specified in Division 1.

G. TO REMAIN: Where indicated on the Drawings, the designated facilities shall remain intact and in service during the prosecution of the demolition work.

3.04 DEWATERING OF EXISTING PROCESS UNITS AND DISPOSAL OF RESIDUE

The Contractor shall notify the City prior to beginning the dewatering work on any existing process units which contain wastewater, grit, or sludge. The Contractor, at his own expense, shall remove the entire contents of each structure and dispose off-site. The proper transport and disposal of all residues shall remain the responsibility of the Contractor.

PART 1 – GENERAL

1.1 SCOPE OF WORK

A. Furnish all labor, material and equipment for the construction of the water distribution system as shown on the drawings from taps to the public system to building plumbing connection.

B. Testing and disinfection of the installed system is incidental to the work.

C. Furnish construction staking in accordance with generally accepted practice for layout of underground utilities.

D. The work includes coordination with building plumbing Contractors and building plumbing plans.

1.2 QUALITY ASSURANCE

A. Meet the requirements of the local Authority Having Jurisdiction. Where conflict exists between these specifications, whichever is most stringent shall applies.

1.3 JOB CONDITIONS

A. Coordinate installation of the water distribution system with grading and paving operations.

B. After completion and testing of the water distribution system, furnish the Owner with the Contractor's Material and Test Certificates required by the National Fire Protective Association.

PART 2 – PRODUCTS

2.1 PIPE

A. Unless noted otherwise all pipe shall be Ductile Iron Pipe. All watermains shall be (ductile iron pipe) D.I.P. conforming to ANSI A21.51 or AWWA C151. All domestic service supply pipe shall be copper pipe.

1. Use copper pipe Type K or L, furnished and installed in accordance with the requirements of the Georgia State Plumbing Code.

2.2 VALVES AND BOXES:

A. For valves 1" and larger use cast iron gate valves, AWWA C500 or C509, metal or resilient seated, made by a recognized valve manufacturer such as Mueller, Iowa, M&H

or approved equal. Use valves constructed of an interchangeable parts system, with parts readily available, and meet the following requirements:

Iron body bronze-mounted
Double disc, parallel seat “0” ring seal, or resilient seat seals
150 psi minimum working pressure
Counterclockwise (left) opening
2-inch operating nut
Non-rising stem
Joints as required for connection to main

B. Install underground valves in standard cast iron valve boxes. Use boxes of two-piece screw type, adjustable to suit the depth of bury and type of valve, with a minimum shaft diameter of 5 ¼ inches. Provide one operating wrench for each ten valves furnished, or fraction thereof.

C. Fire Hydrant shall conform to Local Authority Having Jurisdiction Standards.

2.3 WATER METERS:

A. Water meters will be furnished by Owner.

2.4 DETECTION TAPE

A. Lay metallic detection tape where PVC Pipe is installed atop the pipe in the trench no less than 18” and no more than 24” below finish grade.

B. Meet pipe manufacture’s specification.

2.5 BACKFLOW PREVENTERS

A. General: Manufactured backflow preventers, of size indicated for maximum flow rate and maximum pressure loss indicated.

B. Working Pressure: 150 psig (1035 kPa) minimum, unless otherwise indicated.

2.6 ANCHORAGES

A. Clamps, Straps and Washers: ASTM 506, Steel.

B. Rods: ASTM A 575, steel

C. Rod Couplings: ASTM A 197 (ASTM A 197M), malleable iron.

D. Bolts: ASTM A 307, steel.

E. Cast-Iron Washers: ASTM A 126, gray iron.

F. Concrete Reaction Backing: Portland cement concrete mix, 3000 psig (20.7 Mpa).

1. Cement: ASTM C 150, Type 1.

PART 3 – EXECUTION

3.1 GENERAL

A. Line and Grade: Lay and maintain all pipe to the required lines and grades with fittings, valves, and hydrants at the required locations and with joints centered and spigots hung with all valve and hydrant stems plumb.

B. Protecting Underground and Surface Structures: Furnish at your own expense, temporary support, adequate protection and maintenance of all underground and surface utility structures, drains, sewers, and other obstructions encountered in the progress of the work.

C. Sub-Surface Exploration: Whenever necessary to determine the location of existing pipes, valves, or other underground structure, examine all available records and make all explorations and excavations for such purpose.

3.2 LAYING PIPE

A. General: Before lowering pipe into trenches, grade the bottom of the ditch so that when pipe is in the ditch, it will have a bearing for its entire length. Carefully examine the pipe for defects and clean the inside. After placing pipe into ditch, wipe free of all dirt, sand and foreign material the bell, gasket and spigot. Apply to the gasket and spigot a film of lubricant. Enter the plain ends of the pipe into the socket and force the pipe into the socket until it makes contact with the bottom of the socket.

B. Trench Water: At times when pipe laying is not in progress, plug the open ends of the pipe by approved means and so no trench water enters the pipe.

C. Cutting Pipe: Perform cutting of pipe for inserting valves, fittings or closure pieces in a neat and workmanlike manner without damage to the pipe, using approved mechanical cutters.

D. Direction of Laying: Unless otherwise directed, lay pipe with bell ends facing in the direction of laying. For lines on an appreciable slope, bells face upgrade.

E. Permissible Deflection: Whenever necessary to deflect pipe from a straight line either in the vertical or the horizontal plane to avoid obstruction, to plumb stems, or where

long radius curves are permitted, use the degree of deflection recommended by the manufacturer of the pipe.

F. If wet or otherwise unstable trench conditions are encountered, undercut the trench 6 inches and install the pipe in #57 stabilization stone. If rock is encountered, undercut the trench 6 inches and install the pipe in #57 stone.

3.3 BACKFILLING

A. Immediately after pipes are laid, backfill all trenches and excavations, unless other protection for the pipe line is directed. Use backfilling material selected and deposited with special reference to the future safety of the pipes. Tamp solidly, clean earth or sand about the pipe up to the level of 6 inches above the top of the pipe and carefully deposit in uniform layers, solidly tamp or ram each layer with proper tools so as not to disturb or injure the pipeline. Mechanical means may be permitted for backfilling, provided the equipment meets the approval of the Owner. Ram or tamp the remainder of the backfilling in layers of not more than 6 inches in depth with either approved mechanical or hand tamps. Compact as specified under the EARTHWORK Section of these specifications.

B. Use backfilling material free of rock, trash and debris.

3.4 SETTING APPURTENANCES

A. Valve and Fittings: Set and joint gate valves and pipe fittings to new pipe in the manner previously specified for cleaning, laying, and jointing pipe.

B. Valve Boxes: Support, maintain center and plumb over the wrench nut of the gate valve with box cover flush with the surface of the finished pavement or at such other level as may be directed.

3.5 STERILIZATION

A. Sterilize in accordance with AWWA C601. Sterilize by the application of clear water containing a minimum of 50 ppm of available chlorine. Keep the chlorine bearing water in contact with the surfaces being sterilized for a period of not less than 24 hours. At the end of the contact period, maintain the chlorine residual in all units and at extremities of pipelines at a minimum concentration of 25 ppm.

B. Chlorinating Valves and Hydrants: Operate all valves and other appurtenances while the pipeline is filled with the chlorinated agent.

C. Final Flushing and Test: Following chlorination, thoroughly flush all treated water from the newly laid pipeline at its extremities until the replacement water throughout its length, upon test, meets the requirements of the Local Jurisdiction. Arrange for test samples.

D. Repetition of Procedures: Should the initial treatment prove ineffective, repeat the chlorinating procedure until confirmed tests show that water sampled conforms to the requirements previously stated.

3.6 ALTERNATE TESTING AND STERILIZATION

A. Local Jurisdiction may request alternate or additional testing and sterilization methods. Deviations from these methods may be employed with permission of the Local Jurisdiction.

3.7 WORK ON EXISTING MAINS

A. Connections

1. Connections between the new construction and existing mains may be made by the Local Jurisdiction.
2. Water service may be brought to the property line by the Local Jurisdiction. Connect site piping to the Local Jurisdiction main.
3. Verify the extent of Local Jurisdiction work and coordinate the work with the work of the Local Jurisdiction to provide proper locations and complete assemblies for the water service, meters, taps and appurtenances.

3.8 FEES

A. Contractor is responsible for payment of ANY AND ALL fees associated with the project. It is the Contractor's responsibility to identify all fees related to permit, water main installation and clarify prior to bid submittal whether tap, meter, and any other fees to be paid.

END OF SECTION

Part 1 General

1.01 Scope

A. This Section describes products to be incorporated into sewers and accessories and requirements for the installation and use of these items. Furnish all products and perform all labor necessary to fulfill the requirements of these Specifications.

B. General: Supply all products and perform all Work in accordance with applicable American Society for Testing and Material (ASTM), American Water Works Association (AWWA), American National Standards Institute (ANSI), or other recognized standards. All Work shall be performed in strict accordance with Local Authority Having Jurisdiction Standards applicable to the sanitary sewer construction being performed. Latest revisions of all standards are applicable.

1.02 Qualifications

If requested by the Engineer, submit evidence that manufacturers have consistently produced products of satisfactory quality and performance for a period of at least two years.

1.03 Submittals

Four complete copies of engineering data, including shop drawings, shall be submitted to the Engineer for review and approval.

1.04 Transportation and Handling

A. Unloading: Furnish equipment and facilities for unloading, handling, distributing, and storing pipe, fittings, valves, and accessories. Make equipment available at all times for use in unloading. Do not drop or dump materials. Any materials dropped or dumped will be subject to rejection without additional justification.

B. Handling: Handle pipe, fittings, valves, and accessories carefully to prevent shock or damage. Handle pipe by rolling on skids, forklift, or front loader. Do not use material damaged in handling.

C. Lined pipe shall be handled and transported to prevent damage to linings.

1.05 Storage and Protection

A. Store all pipe which cannot be distributed along the route. Make arrangements for the use of suitable storage areas.

B. Stored materials shall be kept safe from damage. The interior of all pipe, fittings, and other appurtenances shall be kept free from dirt or foreign matter at all times.

Valves shall be drained and stored in a manner that will protect them from damage by freezing.

C. Pipe shall not be stacked higher than the limits recommended by the manufacturer. The bottom tier shall be kept off the ground on timbers, rails, or concrete. Pipe in tiers shall be alternated: bell, plain end; bell, plain end. At least two rows of timbers shall be placed between tiers and chocks, affixed to each other in order to prevent movement. The timbers shall be large enough to prevent contact between the pipe in adjacent tiers.

D. Store joint gaskets in a cool location, out of direct sunlight. Gaskets shall not come in contact with petroleum products. Gaskets shall be used on a first-in, first-out basis.

1.06 Quality Assurance

A. Product manufacturers shall provide the Engineer with written certification that all products furnished comply with all applicable provisions of these Specifications.

B. If ordered by the Engineer, each pipe manufacturer shall furnish the services of a competent factory representative to supervise and/or inspect the installation of pipe. This service will be furnished for a minimum of five days during initial pipe installation.

Part 2 Products

2.01 Polyvinyl Chloride (PVC) Gravity Sewer Pipe

A. Acceptability of PVC pipe for gravity sewers is indicated in the following table:

Standard Minimum Thickness Type PVC[1]	Wall	Acceptable Manufacturers	≤ 6	8 to 15	18	21	24	30 to 48
ASTM D 3034 SDR 35 12454B	SW	Open Certainteed J-M Pipe	Yes	Yes	No	No	No	No

B. All pipes shall have a minimum pipe stiffness of 46 psi at five percent deflection as determined by ASTM D 2412.

C. PVC gravity sewer pipe shall be supplied in lengths not longer than 13 feet.

D. Fittings:

1. Fittings 12 inches in diameter and less shall be manufactured in accordance with ASTM D 3034. PVC compound shall be 12454B or 12454C as specified in ASTM D 1784.

a. For sizes 6-inches and less in diameter, fittings shall be molded in one-piece with no solvent welded joints. Minimum socket depths shall be as specified in ASTM D 3034, Table 2.
b. For sizes 10-inches and larger in diameter, fittings shall be fabricated from pipe conforming to ASTM D 3034 using solvent welding. No field fabrication of fittings will be allowed. All such fabrication shall be performed at the factory and the fittings shall be delivered ready for use.

2. Fittings 18-inches in diameter and larger shall be fabricated from pipe conforming to ASTM F 679 using solvent welding. No field fabrication of fittings will be allowed. All such fabrication shall be performed at the factory and the fittings shall be delivered ready for use.

E. Joints: Joints for pipe and fittings shall be of the integral bell and spigot type with a confined elastomeric gasket having the capability of absorbing expansion and contraction without leakage, when tested in accordance with ASTM D 3212. Gaskets shall meet the requirements of ASTM F 477. The joint system shall be subject to the approval of the Engineer and shall be identical for pipe and fittings.

F. Manhole Connections – Solid Wall and Closed Profile wall Pipe: The sewer shall be connected to manholes utilizing a standard pipe section.

G. Acceptance: Acceptance will be on the basis of the Engineer's inspection and the manufacturer's written certification that the pipe and fittings were manufactured and tested in accordance with the applicable standards.

2.02 Reinforced Concrete Pipe (RCP)

A. Pipe:

1. Pipe shall be bell and spigot reinforced concrete conforming to ASTM C 76 for Class III or special design pipe, unless shown otherwise on Drawings. Wall thickness design shall correspond to Wall C.

2. In addition, the pipe and materials shall meet the following requirements:

a. Concrete shall have a minimum compressive strength of 5,000 psi for Class III and IV and 6,000 psi for Class V and special design;

b. Cement shall meet the requirements of ASTM C 150, Type II.

c. Absorption shall not exceed six percent when tested in accordance with ASTM C 497.

3. Reinforced concrete pipe shall be supplied in lengths of at least six feet.

B. Joints:

1. Joints for pipe 24-inches and larger shall have steel end rings with rubber O-ring gaskets conforming to ASTM C 361.

2. Pipe less than 24-inches in diameter shall have concrete and rubber gasket type joints conforming to ASTM C 361. In addition, joints for pipe less than 24-inches in diameter shall conform to Joint Type R-4 as designated by the U.S. Department of the Interior Standard Specifications for Reinforced Concrete Pressure Pipe.

3. A rectangular groove shall be supplied in the spigot end to receive the rubber O-ring gasket, and it shall be so formed that when the joint is complete the gasket will be deformed to a rectangular shape and confined on all four sides. Bell and spigot surfaces shall be accurately formed and smooth to provide a close sliding fit with a nominal clearance of 1/16-inch.

4. The steel end ring, on both the spigot and the bell ends, shall be provided with a 4-inch wide skirt. The skirt shall be 14 gauge and shall be connected to the end ring by a continuous weld for the full circumference. The skirt shall be welded to the wall or joint reinforcing. The skirt shall be provided with a 1.00-inch impact collar/waterstop, 0.25-inch thick, perpendicular to the skirt and located at the center of the skirt. The impact collar/waterstop shall be continuously welded for the full circumference to the skirt. All steel surfaces not encased in concrete shall be galvanized.

5. The steel end O-ring pipe joint shall also be provided with a butyl rubber sealant. Butyl rubber sealant shall have a minimum nominal diameter of 1-inch and shall be equal to Kent Seal No. 2 or Concrete Sealants CS-202. The sealant shall be installed on the shoulder of the spigot in such a manner that the sealant will be compressed by the jointing of the bell and spigot and fill the void between the bell and spigot.

C. Fittings: Reinforced concrete pipe fittings shall meet all requirements for reinforced concrete pipe including materials of construction, structural strength, linings, and joints.

D. Epoxy Lining:

1. Lining Material: The lining material shall be Protecto 401 Ceramic Epoxy, a two component, modified epoxy formulated for corrosion control with the following minimum requirements:

a. A permeability rating of 0.0 perms when measured by ASTM 96-66, Procedure A. Duration of test – six weeks.

b. A direct impact resistance of 125 inch-pounds with no cracking when measured by ASTM D-2794.

c. The ability to build at least 50 mls dry in one coat.

d. The material shall be recoatable with itself for at least seven days with no additional surface preparation when exposed to direct summer sun and a temperature of 90 degrees F.

e. The material shall contain at least 20 percent by volume of ceramic quartz pigment.

f. A test service history demonstrating the ability of the material to withstand the service expected.

g. Possess a minimum solids volume content of 88 percent, ± one percent.

h. Possess a maximum drying time to allow recoating as follows: 50 degrees F – 72 hours; 75 degrees F -18 hours; 90 degrees F –eight hours. If recoating cannot be accomplished within seven days, a light brush blast shall be performed to improve intercoat adhesion.

2. Surface preparation and Application: After the pipe has cured, the equivalent of seven days at 77 degrees F, the interior of the pipe exposed to liquids and gases shall be blasted and cleaned to remove all loose laitance, form oil or other loose material. After cleaning, the lining material shall be applied to yield 40 mils for the complete system using a centrifugal lance applicator. No lining shall take place over grease, oil, etc., that would be detrimental to the adhesion of the compound to the substrate. The compound shall not be applied when the substrate temperature is below 40 degrees F or in adverse atmospheric conditions which will cause detrimental blistering, pinholing, or porosity of the film. In no case shall the lining be applied when the concrete surface is above 14 percent moisture content. The lining shall be applied by workers employed by Vulcan Painters, Inc. The workers shall be experienced and competent in the surface preparation, application, and inspection of the lining to be applied.

3. Inspection:

a. All pipe shall be checked for thickness using a magnetic film thickness gauge on metal coupons attached to five percent of the pipe coated.

b. All pipe shall be pinhole detected with a non-destructive 2,500 volt test.

c. Each pipe joint shall be marked with the date of application of the lining system and with its numerical sequence of application of that date.

4. Handling: Equipment used to handle and transport the lined pipe shall be suitable designed and operated not to damage the lining. Any damage that occurs shall be repaired prior to the installation of the pipe in accordance with the manufacturer’s recommendations, so the repaired area is equal to the undamaged lining in all respects.

5. Joints: All surfaces in the joint areas (shoulders, bells, etc.) that are concrete and that are in contact with the sewer liquids and gases shall be prepared for coating and coated as specified for the barrel of the pipe. Galvanized surfaces in the joint areas that are in contact with sewer liquids and gases shall be coated and shall be cleaned of loose concrete and degreased prior to coating with a strong solvent to ensure that nothing interferes with adhesion of the coating to the galvanized steel. Any area in the shoulder of the bell that is not smooth shall be made so using a quick setting epoxy grout. All gasket areas shall receive a hand applied coat of Protecto 401 applied at a rate to achieve 8-10 mils dry film thickness. Care shall be exercised to that all areas exposed to the sewer liquids and gases are coated.

2.03 Manholes and Precast Concrete Products

A. Precast Concrete Sections:

1. Precast concrete sections shall meet the requirements of ASTM C 478. The minimum compressive strength of the concrete in precast sections shall be 4,000 psi.

2. The minimum wall thickness shall be one-twelfth of the inside diameter of the base, riser, or the largest cone diameter. Additionally, the wall thickness shall be sufficient for the proper installation of the rubber boots.

3. Transition slabs which convert bases larger than four feet in diameter to four foot diameter risers shall be destined by the manhole manufacturer to carry the live and dead loads exerted on the slab.

4. Seal joints between precast sections by means of rubber O-ring gaskets or flexible butyl rubber sealant. Butyl rubber sealants shall meet the requirements of AASHTO M-198. Sealant shall be pre-formed type with a minimum nominal diameter of 1-inch. Butyl rubber sealant shall be equal to Kent Seal No. 2 or Concrete Sealants CS202.

5. Precast sections shall be manufactured such that the spigot end is at the top of each section.

B. Brick and Mortar: Brick shall be whole and hardburned, conforming to ASTM C 32 Grade MS. Mortar shall be made of one part Portland cement and two parts clean sharp sand. Cement shall be Type 1 and shall conform to ASTM C 150. Sand shall meet ASTM C 144.

C. Iron Castings:

1. Cast iron manhole frames, covers, and steps shall meet the requirements of ASTM A 48 for Class 30 gray iron and all applicable local standards. All castings shall be tough, close grained, smooth, and free from blow holes,

blisters, shrinkage, strains, cracks, cold shots, and other imperfections. No casting will be accepted which weighs less than 95 percent of the design weight. Shop drawings must indicate the design weight and provide sufficient dimensions to permit checking. All castings shall be thoroughly cleaned in the shop and given two coats of approved bituminous paint before rusting begins.

2. Manhole frames and covers shall be equal to the following:

Type	Design Weight	Manufacture's References	
Standard	270#	Neenah R-1695	Vulcan V-1349
Traffic	400#	Neenah R-1642	Vulcan V-1349
Watertight	400#	Neenah R-1916-F1	Vulcan V-2358

3. All frames and covers shall have machined horizontal bearing surfaces.

4. All manholes shall have watertight frames and covers except where specifically shown otherwise on the Drawings.

5. Watertight covers shall be bolt-down type and shall be equipped with four 1/2-inch stainless steel bolts and a 1/8-inch red rubber or rubber O-ring gasket. Covers shall be rotatable and interchangeable. Bolt holes shall be bored through so that debris entering the bolt hole will fall into the manhole. Bolt holes shall have the full 360 degree circle within the cover's radius when bored through the cover.

D. Plastic Steps: Manhole steps of polypropylene molded around a steel rod equal to products of M.A. Industries may be used.

E. Rubber Boots: Provide performed rubber boots and fasteners equal to those manufactured by Kor-N-Seal or Press Seal Gasket Corporation.

2.04 Miscellaneous Accessories

A. Flexible Adaptor Couplings:

1. Couplings for pipe sizes 15-inches in diameter and less shall be elastomeric plastic sleeves designed to connect pipes of dissimilar materials. Adapters shall provide a positive seal against infiltration and exfiltration and remain leakproof and rootproof up to 4.3 psi. The adaptor manufacturer shall provide all stainless steel clamps and required accessories.

2. Couplings shall be products of Fernco and shall be installed in accordance with the manufacturer's recommendations.

B. Flexible Adaptor Donuts:

1. Adaptor donuts shall be elastomeric polyvinyl chloride (PVC), compressible seals designed for sealing joints between sewer pipes of different sizes and/or dissimilar materials. Adapters shall provide a positive seal against infiltration and exfiltration and remain leakproof and rootproof up to 4.3 psi.

2. Donuts shall be products of Fernco and shall be installed in accordance with the manufacturer's recommendations.

C. Detection Tape: Detection tape shall be composed of a solid aluminum foil encased in a protective plastic jacket. Tapes shall be color coded in accordance with APWA color codes with the following legends: Sanitary Sewerage Systems, Safety Green, "Caution: Sewer Line Buried Below". Colors may be solid or striped. Tape shall be permanently printed with no surface printing allowed. Tape width shall be minimum 2-inches when buried less than 10-inches below the surface. Tape width shall be minimum 3-inches when buried greater than 10-inches and less than 20-inches. Detection tape shall be equal to Lineguard Type III Detectable or Allen Systems Detectatape.

2.05 Concrete

Concrete shall have a compressive strength of not less than 3000 psi, with not less than 5.5 bags of cement per cubic yard and a slump between 3 and 5-inches. For job mixed concrete, submit the concrete mix design for approval by the Engineer. Ready-mixed concrete shall be mixed and transported in accordance with ASTM C 94. Reinforcing steel shall conform to the requirements of ASTM A 615, Grade 60.

Part 3 Execution

3.01 Existing Utilities and Obstructions

A. The Drawings indicate utilities or obstructions that are known to exist according to the best information available to the Owner. The Contractor shall call the Utilities Protection Center (UPC) (325-5000 or 1-800-282-7411) as required by Georgia law (Code Section 25-9-1 through 25-9-13) and all utilities, agencies, or department that own and/or operate utilities in the vicinity of the construction work site, at least 72 hours (three business days) prior to construction, to verify the location of the existing utilities.

B. Existing Utility Location: The following steps shall be exercised to avoid interruption of existing utility service.

1. Provide the required notice to the utility owners and allow them to locate their facilities according to Georgia law. Field utility locations are valid for only ten days after original notice. The Contractor shall ensure at the time of any excavation that a valid utility location exists at the point of excavation.

2. Expose the facility to verify its true location and grade for a distance of at least 200 feet in advance of pipeline construction to verify its true location and grade. Repair, or have repaired, any damage to utilities resulting from locating or exposing their true location.

3. Avoid utility damage and interruption by protecting it with means or methods recommended by the utility owner.

4. Maintain a log identifying when phone calls were made, who was called, area for which utility relocation was requested and work order number issued, if any. The Contractor shall provide the Engineer an updated copy of the log bi-weekly, or more frequently, if required.

C. Conflict with Existing Utilities:

1. Horizontal Conflict: Horizontal conflict shall be defined as when the actual horizontal separation between a utility, main, or service and the proposed water main does not permit safe installation of the sewer by the use of sheeting, shoring, tieing-back, supporting, or temporarily suspending service of the parallel or crossing facility. The Contractor may change the proposed alignment of the sewer to avoid horizontal conflicts if the new alignment remains within the available right-of-way or easement and complies with regulatory agency requirements after a written request to and subsequent approval by the Engineer. Where such relocation of the sewer is not approved by the Engineer, the Contractor shall arrange to have the utility, main, or service relocated.

2. Vertical Conflict: Vertical conflict shall be defined as when the actual vertical separation between a utility, main, or service and the proposed sewer does not permit the crossing without immediate or potential future damage to the utility, main, service, or the sewer. The Contractor may change the proposed grade of the sewer to avoid vertical conflicts if the changed grade provides minimum required capacity, maintains adequate cover and complies with regulatory agencies requirements, after written request to and subsequent approval by the Engineer. Where such relocation of the sewer is not approved by the Engineer, the Contractor shall arrange to have the utility, main, or service relocated.

D. Electronic Locator: Have available at all times an electronic pipe locator and a magnetic locator, in good working order, to aid in locating existing pipe lines or other obstructions.

E. Water and Sewer Separation:

1. Sewers should maintain a minimum 10 foot edge-to-edge separation from water mains. Where the sewer crosses a water main, an 18-inch vertical separation shall be maintained where possible. Where possible, a full joint of

sewer pipe shall be centered over the water main. Any deviation shall be requested in writing to the Engineer.

2. Where the sewer crosses over a water main, the water main shall be encased in concrete to the first joint in each direction.

3. No water main shall be permitted to pass through or come in contact with any part of a manhole.

3.02 Pipe Distribution

A. Pipe shall be distributed and placed in such a manner that will not interfere with traffic.

B. No pipe shall be strung further along the route than 500 feet beyond the area in which the Contractor is actually working without written permission from the Owner. The Owner reserves the right to reduce this distance to a maximum distance of 200 feet in residential and commercial areas based on the effects of the distribution to the adjacent property owners.

C. No street or roadway may be closed for unloading of pipe without first obtaining permission from the proper authorities. The Contractor shall furnish and maintain proper warning signs and obstruction lights for the protection of traffic along highways, streets, and roadways upon which pipe is distributed.

D. No distributed pipe shall be placed inside drainage ditches.

E. Distributed pipe shall be placed as far as possible from the roadway pavement, but no closer than five feet from the roadway pavement, as measured edge-to-edge.

3.03 Location and Grade

A. The Drawings show the alignment and grade of the sewer and the position of manholes and other appurtenances. The slope shown on the profile and/or called for in the Specifications is the slope of the invert of the pipe.

B. From the information on the Drawings and the survey points found on the Project site, the Contractor shall perform all surveys necessary for the establishment of the horizontal and vertical alignment of the sewer.

C. Reference Points:

1. The Contractor shall take all precautions necessary, which includes, but is not necessarily limited to, installing reference points, in order to protect and preserve the centerline.

2. Reference points shall be placed, at or no more than three feet, from the outside of the construction easement or right-of-way. The location of the

reference points shall be recorded in a log with a copy provided to the Engineer for use prior to his verifying reference point locations. Distances between reference points and the manhole centerlines shall be accurately measured to the nearest 0.01 foot.

3. The Contractor shall give the Engineer reasonable notice that reference points are set. The reference point locations must be verified by the Engineer prior to commencing clearing and grubbing operations.

D. Cut Sheets:

1. Cut sheets shall be utilized for basis of payment and confirming that the profile is as shown on the Drawings.

2. Prior to beginning installation of any section of the gravity sewer, prepare cut sheets from field run ground elevations and submit them to the Engineer for approval.

3. The survey, from which cut sheets are prepared, may be performed prior to or after clearing and grubbing operations. The surveyor shall obtain an elevation on each benchmark shown on the Drawings and provide this information to the Engineer.

4. No installation of the sewer shall commence prior to approval of the cut sheets.

5. Cut sheets shall provide the station (to the nearest 1 foot) and the elevation (to the nearest 0.1 foot) at a maximum 100 foot intervals, plus at each change in slope of the ground and at each manhole centerline. The cut sheet shall also show the invert elevation of the sewer at the corresponding sewer station. From a straight line interpolation of the data, the Contractor shall calculate and record the station of each point where there is a change in the cut brackets indicated on the Bid form. The Contractor shall calculate and record the length of the sewer between each change in cut bracket. The Contractor shall also indicate the pipe material and class as well as the type of bedding. The slope of the sewer shall also be indicated between manholes. At least one offset hub or temporary benchmark shall be provided at each manhole. Its elevation and the resulting cut from the hub to the manhole invert shall also be shown on the cut sheets.

E. Construction shall begin at the low end of the sewer and proceed upstream without interruption. Multiple construction sites shall not be permitted without written authorization from the Engineer for each site. As a minimum, cut sheets between construction sites shall be submitted and approved before multiple construction sites will be permitted.

F. The Contractor shall be responsible for any damage done to reference points, base lines, center lines, and temporary benchmarks, and shall be responsible for the cost

of re-establishment of reference points, base lines, center lines, and temporary benchmarks as a result of the operations.

3.04 Laying and Jointing Pipe and Accessories

A. Lay all pipe and fittings to accurately conform to the lines and grades established by the Engineer.

B. Pipe Installation:

1. Proper implements, tools, and facilities shall be provided for the safe performance of the Work. All pipe, fittings, and valves shall be lowered carefully into the trench by means of slings, ropes, or other suitable tools or equipment in such a manner as to prevent damage to sewer materials and protective coatings and linings. Under no circumstances shall sewer materials be dropped or dumped into the trench.

2. All pipe, fittings, valves, and other appurtenances shall be examined carefully for damage and other defects immediately before installation. Defective materials shall be marked and held for inspection by the Engineer, who may prescribe corrective repairs or reject the materials.

3. All lumps, blisters, and excess coating shall be removed from the socket and plain ends of each pipe, and the outside of the plain end and the inside of the bell shall be wiped clean and dry and free from dirt, sand, grit, or any foreign materials before the pipe is laid. No pipe which contains dirt shall be laid.

4. Foreign material shall be prevented from entering the pipe while it is being placed in the trench. No debris, tools, clothing, or other materials shall be placed in the pipe at any time.

5. As each length of pipe is placed in the trench, the joint shall be assembled and the pipe brought to correct line and grade. The pipe shall be secured in place with approved backfill material.

6. It is common practice to lay pipe with the bells facing the direction in which work is progressing; however, it is not mandatory.

7. Applying pressure to the top of the pipe, such as with a backhoe bucket, to lower the pipe to the proper elevation or grade shall not be permitted.

8. Provide detection tape for all non-metallic pipe. Detection tape shall be buried 4 to 10-inches deep. Should detection tape need to be installed deeper, the Contractor shall provide 3-inch wide tape. In no case shall detection tape be buried greater than 20-inches from the finish grade surface.

C. Alignment and Gradient:

1. Lay pipe straight in alignment and gradient or follow true curves, where shown on the Drawings, as nearly as practicable. Do not deflect any joint more than the maximum deflection recommended by the manufacturer.

2. Maintain a transit, level, and accessories on the job to lay out angles and ensure that deflection allowances are not exceeded.

3. The Contractor shall check the invert elevation at each manhole and the pipe invert elevation at least three times daily, start, mid-day, and the end of day. Elevations shall be checked more frequently if more than 100 feet of pipe is installed in a day or if the pipe is being constructed at minimum slope.

4. The Contractor shall check the horizontal alignment of the sewer at the same schedule as for invert elevations.

D. Expediting of Work: Excavate, lay the pipe, and backfill as closely together as possible. Do not leave unjointed pipe in the trench overnight. Backfill and compact the trench as soon as possible after laying and jointing is completed. Cover the exposed end of the installed pipe each day at the close of work and at all other times when work is not in progress. If necessary to backfill over the end of an uncompleted pipe or accessory, close the end with a suitable plug, either push-on, mechanical joint, restrained joint, or as approved by the Engineer.

E. Joint Assembly:

1. Push-on, mechanical, flange, and restrained type joints shall be assembled in accordance with the manufacturer's recommendations.

2. Each restrained joint shall be inspected by the Contractor to ensure that it has been "homed" 100 percent.

3. The Contractor shall internally inspect each pipe joint to insure proper assembly for pipe 24-inches in diameter and larger after the pipe has been brought to final alignment.

4. Field welding of steel pipe joints shall conform to the requirements of AWWA C206. All welding shall be performed by persons meeting the qualification requirements of AWA D1.1.

F. Cutting Pipe:

1. Cut ductile iron pipe using an abrasive wheel saw.

2. Cut PVC pipe using a suitable saw.

3. Remove all burrs and smooth the end before jointing.

4. The Contractor shall cut the pipe and bevel the end, as necessary, to provide the correct length of pipe necessary for installing the fittings, valves, accessories, and closure pieces in the correct location. Only push-on or mechanical joint pipe shall be cut.

G. Lining Repair: Repair polyethylene or polyurethane linings and recoat spigot ends of cut pipe with a product equal to Protecto 101 or Madewell 1104 coal tar epoxy in accordance with the manufacturer's recommendations and as specified below:

1. Remove all burrs and areas of loose lining materials by sanding or scraping to bare metal.

2. Remove oil and lubricants used during field cutting.

3. Lining shall be stripped back a minimum of 1-inch from the spigot end into well adhered lined areas.

4. Roughen 1 to 2-inches of good lining with a rough grade (40 grit) emery paper, rasp, or small chisel, to allow overlap between new and existing lining.

5. Apply lining repair material in the number of coats required to match the thickness requirements as specified in Part 2 of this Section and in accordance with the manufacturer's recommendations.

3.05 Manhole and Precast Concrete Product Construction

A. Construct manholes as shown on the Drawings.

B. Precast Concrete: Handle sections carefully to prevent cracking or chipping. Provide uniform bedding of the bottom section to prevent uneven loading. Install gaskets and joint sealants in accordance with manufacturer's recommendations to produce a watertight structure.

C. Pipe Tee: Place, joint, and properly backfill the pipe tee prior to placing any riser sections. Meet all requirements for precast manholes.

D. Brick: Bed the bottom and sides of every brick in mortar. Apply a smooth coat of mortar, 3/4-inch thick, on the inside and outside.

E. Pipe Connections: All pipes shall be connected to precast concrete manholes by a rubber boot provided in a cored or precast hole of the proper diameter.

F. Inverts: Form channels as shown on the Drawings, rounded, and troweled smooth. Maintain consistent grade through the invert.

G. Top Elevations: Build manholes outside of paved areas to finished grade unless otherwise shown on the Drawings or directed by the Engineer. Build manholes in paved areas to existing grades.

H. Frames and Covers: Unless frame and cover is at grade, the frame shall be cast into the cone section.

I. Seal all manhole joints and lift holes, both inside and out, with grout. Between precast sections, this is in addition to joint sealant.

J. Invert Elevations: The invert elevations shown on the Drawings shall be for the invert at the centerline of the precast concrete manhole. Prior to setting the laser or other vertical alignment control system for the sewer upstream of the manhole, the Contractor shall verify the elevation of the sewer installed at the manhole. Should the elevation differ from that shown on the Drawings, the Contractor shall take the following corrective action:

1. If the sewer is laid at negative grade, the Contractor shall remove and reinstall the sewer at the correct grade at no additional cost to the Owner.

2. If the sewer is laid at a grade less than that shown on the Drawings, thus reducing the sewer's capacity, the Owner may required the sewer to be removed and relaid at the correct grade at no additional cost to the Owner. As a minimum, the grade to the next upstream manhole shall be adjusted such that the next upstream manhole shall be set at the correct elevation.

3. If the sewer is laid at a grade greater than that shown on the Drawings, and if the Contractor can shown that there are no conflicts with upstream existing utilities or obstructions, the Contractor shall adjust the grade of the next upstream manhole such that the next upstream manhole shall be set at the correct elevation. If such an adjustment, in the Engineer's opinion, is substantial, the grade adjustment shall be spread over multiple sections of the sewer. If such an adjustment, in the Owner's opinion, significantly reduces the sewer's capacity, the Owner may require the Contractor to remove and relay that portion of the sewer laid at the improper grade.

K. Manholes shall be constructed such that their walls are plumb.

3.06 Concrete Collars

Construct collars as shown on the Drawings.

3.07 Inspection and Testing

A. Clean and test lines before requesting final acceptance. Where any obstruction is met, clean the sewers by means of rods, swabs, or other instruments. When requested by Cobb County or the Project Engineer, flush out lines and manholes before final inspection.

B. Gravity Sewers: Pipe lines shall be straight and show a uniform grade between manholes. Correct any discrepancies discovered during inspection.

1. Infiltration Tests: Use only when groundwater is two feet above the top of the pipe.

    a. Install suitable weirs in manholes selected by the Engineer to determine the leakage of ground water into the sewer. The maximum length of line for each infiltration test shall be 5,000 feet. Measure leakage only when all visible leaks have been repaired and the groundwater is two feet above the top of the pipe. If leakage in any section of the sewer line exceeds 100 gpd/inch diameter/mile, locate and repair leaks. Repair methods must be approved by the Engineer. After repairs are completed, re-test for leakage.

    b. Furnish, install, and remove the necessary weirs, plugs, and bulkheads required to perform the leakage tests. Where continuous monitoring of flow level is required, the Owner will provide and operate monitoring equipment.

2. Exfiltration Tests: Choose one of the following when groundwater is not two feet above the top of the pipe.

    a. Hydrostatic Test:

        i. Test pipe between manholes with a minimum of 10 feet hydrostatic pressure, measured at the center of the pipe at the upstream manhole.

        ii. The ends of the pipe in the test section shall be closed with suitable watertight bulkheads. Inserted into the top of each bulkhead shall be a 2-inch pipe nipple with an elbow. At the upper end of the test section, a 12-inch riser pipe shall be connected to the 2-inch nipple. The test section of pipe shall be filled through the pipe connection in the lower bulkhead which shall be fitted with a valve, until all air is exhausted and until water overflows the riser pipe at the upper end. Water may be introduced into the pipe 24 hours prior to the test period to allow complete saturation. House service lines, if installed, shall also be fitted with suitable bulkheads having provisions for the release of air while the test section is being filled with water.

        iii. During the test period, which shall extend over a period of two hours, water shall be introduced into the riser pipe from measured containers at such intervals as are necessary to maintain the water level at the top of the riser pipe. The total volume of water added during the test period shall not exceed that specified for infiltration.

    b. Low-Pressure Air Test

i. Prior to air testing, the section of sewer between manholes shall be thoroughly cleaned and wetted. Immediately after cleaning or while the pipe is water soaked, the sewer shall be tested with low-pressure air. At the Contractor's option, sewers may be tested in lengths between manholes or in short sections (25 feet or less) using inflatable balls pulled through the line from manhole to manhole. Air shall be slowly supplied to the plugged sewer section until internal air pressure reaches approximately 4.0 psi. After this pressure is reached and the pressure allowed to stabilize (approximately two to five minutes), the pressure may be reduced to 3.5 psi before starting the test. If a 1.0 psi drop does not occur within the test time, then the line has passed the test. If the pressure drops more than 1.0 psi during the test time, the line is presumed to have failed the test, and the Contractor will be required to locate the failure, make necessary repairs, and retest the line. Minimum test time for various pipe sizes, in accordance with ASTM C 828 is as follows:

Nominal Pipe Size, Inches	T(Time Min/100) Feet
6	0.7
8	1.2
10	1.5
12	1.8
15	2.1
18	2.4
21	3.0
24	3.6

ii. Required test equipment, including inflatable balls, braces, air hose, air source, timer, rotameter as applicable, cut-off valves, pressure reducing valve, 0-15 psi pressure gauge, 0-5 psi pressure gauge with gradations in 0.1 psi and accuracy of ± two percent, shall be provided by the Contractor. Testing equipment shall be equal to Cherne Air-Loc Testing Systems.

iii. The Contractor shall keep records of all tests made. Copy of such records will be given to the Engineer or the Owner. Such records shall show date, line number and stations, operator, and such other pertinent information as required by the Engineer.

iv. The Contractor is cautioned to observe proper safety precautions in performance of the air testing. It is imperative that plugs be properly secured and that care be exercised in their removal. Every precaution shall be taken to avoid the possibility of over-pressurizing the sewer line.

3. Deflection Test:

a. Test PVC gravity sewer for excessive deflection by passing a mandrel through the pipe. Deflection of pipe shall not exceed the following:

Nominal Pipe Diameter	Maximum Allowable Deflection
≤ 12-inches	5%
15 to 30-inches	4%
>30-inches	3%

b. The mandrel size shall be based upon the maximum possible inside diameter for the type of pipe being tested, taking into account the allowable manufacturing tolerances of the pipe. The mandrel shall have an odd number of legs, or vanes, with a quantity of such equal to or greater than nine. The legs of the mandrel shall be permanently attached to the mandrel. A mandrel with variable sizes shall not be allowed. The mandrel shall be constructed of steel aluminum or other material approved by the Engineer, and shall have sufficient rigidity so the legs of the mandrel will not deform when pulling through a pipe. The mandrel dimensions shall be checked by the Engineer before use by the Contractor.

c. Excavate and install properly any section of pipe not passing this test. Re-test until results are satisfactory.

d. This test shall be performed within the first 30 days of installation and during final inspection, at the completion of this contract.

3.08 Protection and Restoration of Work Area

A. General: Return all items and all areas disturbed, directly or indirectly by work under these Specifications, to their original condition or better, as quickly as possible after work is started.

1. The Contractor shall plan, coordinate, and prosecute the work such that disruption to personal property and business is held to a practical minimum.

2. All construction areas abutting lawns and yards of residential or commercial property shall be restored promptly. Backfilling of underground facilities, ditches, and disturbed areas shall be accomplished on a daily basis as work is completed. Finishing, dressing, and grassing shall be accomplished immediately thereafter, as a continuous operation within each area being constructed and with emphasis placed on completing each individual yard of business frontage. Care shall be taken to provide positive drainage to avoid ponding or concentration of runoff.

3. Handwork, including raking and smoothing, shall be required to ensure that the removal of roots, sticks, rocks, and other debris is removed in order to provide a neat and pleasing appearance.

4. The County's Engineer and/or Landscape Architect shall be authorized to stop all work by the Contractor when restoration and cleanup are unsatisfactory and to require appropriate remedial measures.

B. Man-Made Improvements: Protect, or remove and replace with the Engineer's approval, all fences, walkways, mail boxes, pipe lines, drain culverts, power and telephone lines and cables, property pins, and other improvements that may be encountered in the work.

C. Cultivated Growth: Do not disturb cultivated trees or shrubbery unless approved by the Engineer. Any such trees or shrubbery which must be removed shall be heeled in and replanted under the direction of an experienced nurseryman.

D. Cutting of Trees: Do not cut trees for the performance of the work except as absolutely necessary. Protect trees that remain in the vicinity of the work from damage from equipment. Do not store spoil from excavation against the trunks. Remove excavated material stored over the root system of trees within 30 days to allow proper natural watering of the root system. Repair any damaged tree over 3-inches in diameter, not to be removed, under the direction of an experienced nurseryman. All trees and brush that require removal shall be promptly and completely removed from the work area and disposed of by the Contractor. No disposal or spoiling of stumps, wood piles, or trash piles will be permitted on this work site.

E. Disposal of Rubbish: Dispose of all materials cleared and grubbed during the construction of the project in accordance with the applicable codes and rules of the appropriate county, state, and federal regulatory agencies. All disposal operations shall be subject to the review and approval of the Owner and Landscape Architect.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Detectable warning systems.

1.2 QUALITY ASSURANCE

A. Qualifications: Installer shall have a minimum of five years experience in installations similar to this project and shall be approved by the detectable warning system manufacturer.

B. Regulatory Requirements: Detectable warning system shall comply with the applicable requirements of the following:
   1. Americans with Disabilities Act (ADA): Title 49 CFR Transportation, Section 4.29.2 Detectable Warnings on Walking Surfaces.
   2. International Building Code, Chapter 11, for detectable warning pavers.
   3. American National Standard Institute (ANSI)
      a. ICC/ANSI A 117.1-98 Accessible and Useable Buildings and Facilities for Detectable Warning Pavers.
   4. U.S. Architectural and Transportation Barriers Compliance Board Americans with Disabilities Act Accessibility Guidelines for Buildings and Facilities (ADAAG).

1.3 DELIVERY, STORAGE, AND HANDLING

A. Reference Section 01600 for general delivery and storage requirements.

B. Deliver materials to project site in manufacturer's original, unopened containers with labels indicating brand names, colors and patterns and quality designations legible and intact.

C. Store and protect materials in accordance with manufacturer's recommendations.

1.4 SITE CONDITIONS

A. Adhere to manufacturer's printed recommendations for environmental requirements.

B. Work area shall be free of traffic and any work by other trades during, and after installation, and shall be protected per manufacturer's printed instructions.

C. Protect finished detectable warning system surfaces from damage by subsequent trades.

PART 2 - PRODUCTS

2.1 DETECTABLE WARNING SYSTEMS

A. Provide tactile cast-in-place panels or tiles or tactile concrete pavers incorporating inline truncated dome pattern measuring 0.2" in height, 0.9" diameter at the base, and 0.4" diameter at top of dome spaced 2.35" nominal as measured side by side. Provide one of the following products:
   1. Cast-In-Place Panels or Tiles:
      a. Cast In Place Armor-Tile Tactile System, by Engineered Plastics Inc., Williamsville, NY. (800) 682-2525. www.armor-tile.com.
      b. Cast in Place CASTinTACT 3 Concrete Tactile Warning Panels, by Mason Supply Company, Portland, OR. Contact (503)234-4321. www.castintact.com.
      c. Cast in Place EZ Set Tile, by Detectable Warning Systems, Inc. Anaheim, CA. (866)999-7452 www.detectable-warning.com.
      d. Cast in Place Detectable Warning Tile, by ADA Solutions, North Billerica, MA.

(800) 372-0519. www.adatile.com.

e. Cast in Place Detectable Warning Panels, by Armorcast Products Company, North Hollywood, CA. (818) 982-3600. www.armorcastprod.com/ada.htm.

2. Concrete Pavers: By one of the following manufacturers:
   a. Hanover Architectural Products, Hanover, PA (800) 426-4242. www.hanoverpavers.com.
   b. Wausau Tile, Wausau, WI (800) 388-8728. www.wausautile.com.
3. Color: Red or yellow

2.2 ACCESSORIES

A. Cleaner: As recommended by manufacturer.

B. Sealer: As recommended by manufacturer.

C. Concrete Paver Accessories:
1. Bedding Sand: Clean, non-plastic, free from deleterious or foreign matter, symmetrically shaped, natural or manufactured form crushed rock.
2. Joint Sand: Fine, sharp, washed natural sand or crushed stone with 100 percent passing No. 16 sieve and no more than 10 percent passing No. 200 sieve.
3. Geotextile Fabric: Refer to Section 02340.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine surfaces and adjacent areas where products will be installed and verify that surfaces or base materials conform to product manufacturer's requirements and as indicated on the drawings.

B. Beginning of installation indicates acceptance of substrate conditions.

3.2 PREPARATION

A. Protect utilities, drainage structures, curbs and any other structures within or adjacent to the treatment location against the application of the surface treatment materials.

3.3 INSTALLATION

A. Install in the locations and pattern as shown on the drawings.

B. Install as shown on the drawings and as recommended by the manufacturer’s written instructions.

C. Cut pavers or panels with motor-driven masonry saw equipment to provide pattern indicated and to fit adjoining work neatly. Use full units without cutting where possible and avoid units cut to less than one quarter of original size

D. Tolerances: Do not exceed 1/16-inch unit-to-unit offset from flush (lippage) or 1/8 inch in 10 feet from level, or indicated slope for finished surface of paving.

E. Install pavers or panels with edges flush with adjacent non-tactile paving.

F. Concrete Pavers:
1. Mix pavers from several pallets or cubes, as they are placed, to produce uniform blend of colors and textures.

2. Place geotextile fabric over compacted base course.
3. Place bedding sand and screed to a thickness necessary to maintain uniform grade, taking care that moisture content remains constant and density is loose and constant until pavers are set and compacted.
4. Place pavers hand tight against spacer bars.
5. Vibrate pavers into leveling course with a low-amplitude plate vibrator.
6. Spread dry sand and fill joints immediately after vibrating pavers into leveling course. Vibrate pavers and add sand until joints are completely filled, then remove excess sand. Leave a slight surplus of sand on the surface for joint filling.
7. Apply and spread joint sand as necessary until joints remain full.

3.4 CLEANING

A. Thoroughly clean surfaces in a method recommended by manufacturer.

B. Replace discolored materials as required.

END OF SECTION

PART 1 GENERAL

1.01 SCOPE

The storm drainage system includes, but is not limited to, construction of storm sewers, drainage structures, drainage appurtenances, rip rap, ditching, backfilling, shoring and dewatering of trenches for storm sewers as required for safe and workmanlike construction.

1.02 QUALITY ASSURANCE

A. Storm drain pipe may be inspected at the manufacturing source as well as at the job site by the Engineer.

B. The Contractor shall notify the Engineer for inspection of pipe and drainage structure installation prior to backfilling trenches.

C. Storm drainage systems serving public streets shall be constructed under the inspection of the owning governmental agency. Final acceptance of the governmental agency is required prior to final payment under this Contract.

1.03 JOB CONDITIONS

A Coordination and Scheduling of the Work: Construction of new sewers and drainage systems shall proceed as early in the construction program as possible. Maintain adequate drainage of the Project area at all times. Prevent flooding of adjacent roads and private properties.

B. Temporary Drainage: Wherever possible, new sewers and inlets to serve the various drainage areas shall be constructed and placed in service. Where this is not possible, temporary drainage facilities shall be provided as required. These may include temporary ditches, slope drains, temporary connections into completed sewers, or such other means as the circumstances may require.

PART 2 PRODUCTS

2.01 BEDDING MATERIAL

Drainage Fill Crushed Stone: Comply with ASTM C 33, Size No. 57.

2.02 RIP RAP

Rip rap shall comply with Georgia Department of Transportation Standard Type 3

2.03 STORM DRAIN PIPE MATERIALS

A. Storm drain pipe is to be of the size and class as shown on the Drawings. Storm pipe shall be RCP where specified on the drawing.

B. Corrugated steel pipe shall conform to AASHTO M36. Pipe shall be furnished with full bituminous coating and asphalt paved inverts conforming to the requirements of AASHTO M190 Specification. A positive means of identifying gauge shall be furnished. Corrugated steel pipe shall be furnished with corrugated bands and with joints equal to Armco "Hugger" type.

2.04 APPURTENANCE MATERIAL

A. Brick

1. Clay or Shale Brick: Comply with ASTM C 32 for sewer brick and manhole brick, grade as selected.

2. Concrete Masonry Units: Comply with ASTM C 139.

B. Mortar: Comply with ASTM C 270, Type M, for pipe joints and manhole and inlet brickwork.

C. Concrete for storm drainage construction shall be in accordance with the requirements of Section 03300 of these Specifications. Strength shall be 4,000 psi at age 28 days.

D. Reinforcement: Comply with ASTM A 615.

E. Castings: Comply with ASTM A 48, grey cast iron.

F. If the Contractor desires to substitute precast drainage structures for structure detailed on the Drawings, the Contractor shall submit design drawings to the Engineer for consideration. If precast structures are acceptable by the Engineer, shop drawings for construction will be required and shall conform to the requirements of Section 01340 of these Specifications.

2.05 INLET STRUCTURES AND CATCH BASINS

Unless otherwise noted, all Inlet structures and catch basins shall be per GDOT standard.

PART 3 EXECUTION

3.01 GENERAL

A. All pipe will be laid in an open trench of dimensions as given below. No projecting conditions will be allowed.

B. Lengths of storm drain pipe shown on the Drawings are approximate distances center to center of structures. Slopes are approximate. The Contractor shall install pipe based on actual field measurements after locating drainage structures in accordance with Drawing requirements.

C. Particular care shall be exercised in establishing the relationship of storm drain pipe, drainage structure bases and final drainage top conditions. Drainage structure tops are required to be located in specific position and orientation. Subsurface construction is to be located to allow drainage structure construction as detailed on the Drawings without modification. In case of misalignment of drainage structure tops and bases, the Contractor will be required to correct the construction as directed by the Engineer.

3.02 EXCAVATION

A. Excavation shall be by open cut. The top portion of trenches may be excavated as required by the Contractor to any width which will not cause damage to any adjacent structure. The lower portion of the trench to a height of one foot above the top of the pipe shall not exceed the dimensions shown on the Drawings.

B. The bottom of trenches shall be carefully shaped to conform to and support the lower one-fourth of the periphery of the pipe barrel. Where rock is encountered, it shall be removed to a depth of 1 foot below the pipe and replaced with an approved soil material.

C. Where wet or otherwise unsuitable material is encountered at or below the invert elevation during excavation, it shall be removed to a point 12-inches below the pipe invert and replaced with selected fill. Where rock is encountered in storm drain trenches, it shall be undercut to a point 12-inches below the pipe invert and replaced with compacted earthfill.

3.03 BACKFILLING

Backfilling shall be done with selected material, free from rock larger than 2-inches in size and free of debris. Backfill shall be carefully placed and tamped around and over the pipe to avoid displacement of the pipe or damage to the joints. All backfill shall be placed in 6-inch lifts and shall meet material and compaction requirements of Section 02200 of these Specifications.

3.04 APPURTENANCES

A. All drainage structures are to be constructed as shown on the Drawings and in accordance with generally accepted construction practice. Refer to Drawings for location and size.

B. The Contractor shall furnish and install drainage structures as shown in detail on the Drawings.

C. Structure bottoms shall have shaped inverts.

D. All mortar joints shall be filled full. Joints shall be struck flush inside and out.

E. All pipe, where cut at the face of the structure wall, shall be cut and ground smooth with the face of the wall.

F. All joints around pipe and structure walls at the face of the wall shall be packed full with mortar.

G. The bottom of drainage structures shall be clean of all debris and walls shall be wiped clean of mortar as the work progresses.

H. Catch basin tops shall be cast-in-place concrete and constructed to line and grade and shall slope continuous with gutter.

I. All structures over four feet deep shall have cast iron steps installed 15-inches on center in a vertical direction. Cast iron steps and manhole rings and covers shall meet ASTM A 48 Specification.

3.05 RIP RAP REPLACEMENT

Rip rap shall be placed as prescribed by the Georgia Department of Transportation Standards.

3.06 DETENTION POND CONSTRUCTION

A. Detention pond construction shall prior to any major earthwork operation. The pond shall be cleaned and built-up sediments removed at the end of the construction.

B. The detention pond is required to be maintained free of silt deposits until such time as Project ground stabilization is complete. Detention pond will be considered for the stage of Substantial Completion when the following occurs:

1. Detention pond construction is complete.

2. Lines and grades as shown on the Drawings are evident with the detention pond free of silt deposits.

3. Ground stabilization for the Project area under this Contract is complete.

3.07 CLEANING

Sewers and structures shall be left clean and free from mud or debris of any kind. When looked through, each line between structures shall show a full circle of light. Otherwise, the Contractor shall be required to remove and replace the defective portion of the work at Contractor's own expense.

END OF SECTION

SECTION 02831 - CHAIN LINK FENCE AND GATES

PART 1 – GENERAL

1.1 SCOPE OF WORK

A. Furnish all labor, material and equipment necessary to install poly-vinyl coated (black) chain link fabric, posts, gates, wire and appurtenances. Fencing and gates as shown on Civil Plans shall be 6 foot high black vinyl coated with barbs above shall be provided and installed.

1.2 REFERENCES

A. Standards of the following as referenced:

1. American Society for Testing and Materials (ASTM).

1.3 SUBMITTALS

A. Product data: Indicate material types, gauges, sizes and finishes.

B. Shop Drawings:

1. Perimeter fence: Site specific plan, typical elevation of fence, and construction details including post spacing and foundation details.
2. Sliding Gate: Site specific plan, elevations, and construction details including post spacing and foundation details.
3. Loop detection system: site specific plan indicating location of loop and distance from gate.
4. Dumpster Enclosure: Site specific plan, elevations, and construction details including post spacing and foundation details.

C. Samples for selections.

PART 2 – PRODUCTS

2.1 MATERIALS

A. Fencing:

1. Provide chain link fence meeting ASTM A491 or ASTM 4392 complete with supports, bracings, gates and other accessories to complete Work indicated.
2. Finish at exposed surfaces: Aluminized fabric in accord with ASTM A491; post, fittings and miscellaneous fittings aluminized in accord with ASTM A491; galvanized fabric coated per ASTM A392.
3. Fence shall be 6’ high to top of fabric. Provide forty-five degree arms supporting three strands of barbed wire above the fabric.

B. Posts:

1. General: Form using round steel sections, galvanized per ASTM 123, of the following sizes:
2. Corner and Terminal Posts: Post shall be constructed of schedule 40 steel pipe. They shall be hot-dipped galvanized with a minimum of 1.8 oz./sq. ft. of coated surface area.

Post shall have an outside diameter of 2-3/8" (2.375"), a minimum wall thickness of .130" and a minimum weight per ft. of 3.117 lb.

3. Line posts: Post shall be constructed of schedule 40 steel pipe. They shall be hot-dipped galvanized with a minimum of 1.8 oz./sq. ft. of coated surface area. Post shall have an outside diameter of 1-7/8" (1.875"), a minimum wall thickness of .120" and a minimum weight per ft. of 2.281 lb.

D. Top and Bottom Rails and Braces: Shall be constructed of schedule 40 steel pipe. They shall be hot-dipped galvanized with a minimum of 1.8 oz./sq. ft. of coated surface area. Post shall have an outside diameter of 1-5/8" (1.625"), a minimum wall thickness of .111" and a minimum weight per ft. of 1.83 lb.

E. Caps, Hardware and Misc.: Post caps shall be formed steel, cast malleable iron or aluminum alloy. Install one cap for each post where barbed wire supporting arms are not required. Top rail and brace ends shall be formed steel, malleable iron or cast iron for connection of rails and braces to terminal posts. Top rail sleeves shall be 6" and allow for expansion and contraction of top rails. Use 9 ga. galvanized steel wire for the attachment to fabric to posts. Double wrap 13 gauge for rails and braces. Hog ring ties of 12-1/2 gauge for attachment of fabric to tension wire. Tension bars shall be in one piece lengths equal to 2" less than full height of fabric with a minimum cross-section of 3/16" x ¾". Install tension bars where chain link fabric meets terminal posts. Install 7-gauge zinc coated tension wire with tensile strength of 75,000 psi at bottom of fence fabric.

F. Barbed Wire and Supporting Arms: Barbed wire shall be double strand 12-1/2 gauge galvanized twisted steel line wire, 4-point galvanized steel barb shall be placed approximately 5" on center. Support arms shall be galvanized pressed steel with provision for supporting three stands of barbed wire. Arms shall withstand 250 lb. downward pull at outermost end without failure.

G. Concrete: Concrete for setting posts shall be 3,000-psi compression strength at 28 days.

H. Gate Frame: Fabricate gate frames from galvanized steel pipe with an outside diameter of not less than 1.9" and a weight per foot of 2.72 lb. Weld connections to form a rigid one-piece unit.

I. Gate Hardware: All hardware shall be constructed from hot-dipped galvanized steel. All moveable parts shall be field coated to match adjacent finishes.

K. Gate Hinges: Hinges shall be structurally capable of supporting gate leaf.

L. Stretcher bars: 3/16" by 3/4" galvanized steel, 2" less in length than fabric width. Provide one stretcher bar at each gate and end post; two at each corner and pull post.

M. Poly-Vinyl Coating: provide for all fence, gate, and post members

1. Provide poly-vinyl extruded coating, 0.015 inches minimum coating thickness, conforming to ASTM F-668, in black.
2. Adhere coating to fabric, posts and appurtenances specified, or otherwise exclude water from entering between coating and coated materials.

N. Siding Gates: Comply with ASTM F 1184

1. Cantilever - Manufacturer's standard top rail gate incorporating a track for the top roller. Brace frame to prevent sagging. Provide a lockable positive latch and other hardware and accessories as required.

(a) Class 1: Provide external rollers with accessible grease fittings, a safety enclosure, and guide posts to keep the gate on the rollers.

O. Plastic Screening Slats (Exterior): Tubular plastic slats designed for use in 2 inch mesh fabric, for vertical installation. Feather Lock Slat by PrivacyLink, Hyde Park, Utah, (800) 574-1076.

1. Color: To be selected by Architect from a full range of manufacturers standard colors.

2.2 GATE OPERATOR

A. General: Manufacturer's standard design and construction, suitable for gates specified. Select operator size and features according to manufacturer's published data, taking into consideration size, type, weight, and construction of gate, as well as Project conditions and specified requirements.

B. Type: Electric motor with enclosed gear reducer and chain drive.

C. Type: Hydraulic drive for smooth, shock-free actuation.

D Speed: Minimum 60 feet per minute.

E. Features: Continuous duty without overloading or overheating. Rated by manufacturer at 30 or more complete cycles per hour. All components UL approved. Furnish disconnect switch with NEMA KS 1; Type 3R enclosure.

1. Provide equipment with suitable electrical characteristics including phase, voltage, branch circuit wire size, overcurrent protection, and connection devices coordinated with Division 16.
2. Self-locking.
3. Weather-resistant steel enclosure protecting all operating parts.
4. Automatic reversing upon obstruction during closing cycle and automatic stop upon obstruction during opening cycle.

F Controls: Electric and electronic programmable controls separated from motor and drive mechanism, sealed from water and insects, with space for additional optional equipment. Provide adjustable automatic closing timer and the following remote control device:

1. Single-button control.
2. Three-button open/close/stop switch.
3. Card reader with codes to allow four different access periods.
4. Vehicle loop and loop detection system: Located for exit access only complying with the following requirements:
   a. Below paving or flush with paving.
5. Fire Strobe 2000 system or approved equivalent complying with the following requirements:
   a. Frequency: 14Hz for class II signals.
   b. Responds to both OPTICOM and STROBECOM II emitters.
   c. Strobe acquisition time: 0.5 seconds
   d. PC board construction: enclosed 8”x8”x4” rain tight NEMA J-Box
   e. Power requirements: 12/24 Volts AC/DC non polarity conscious, approximately 1 Watt

PART 3 – EXECUTION

3.1 INSTALLATION

A. Fence Framing: Install in accordance with ASTM F 567 and manufacturer's instructions. Locate terminal posts at each fence termination. Space line posts at 10 feet centers. Concrete set all posts in holds bored with a diameter at least 4 times greater than the outside dimensions of the post. Holes shall be 42" deep. Set post bottoms 36" below grade. Place concrete in a continuous pour, trowel finish the surface and slope to direct water away from posts. Install horizontal pipe brace at mid-height on each side of terminal posts. Install diagonal truss rods at these points; install braces and adjust truss rod. Install bottom tension wire before stretching fabric and attach to each post with ties or clips. Install the top rail in lengths of 21 feet. Connect top rail joints with sleeves for rigid connection with expansion/contraction. Install fabric on security side, attach so that fabric remains in tension after pulling force is released. Leave approximately 2" between finished grade and bottom of selvedge. Attach fabric with wire ties or clips to line posts at 15" on center, to rails, braces, and tension wire at 24" on center. To install tension bars, pull fabric taut, thread bar through fabric and attach to terminal posts with bands or clips spaced a maximum of 15" on center.

B. Gates: Install gates plumb, level and secure for full opening without interference. Attach hardware by means which will prevent unauthorized removal. Adjust hardware for smooth operation.

C. Accessories: Bend ends of tie wires to minimize hazard to persons and clothing. Install nuts or fasteners opposite the fabric side of the fence for added security Install extension wires on posts and align perpendicular to the fence. Uniformly space parallel rows of barbed wire on the security side of the fence. Pull wire taunt and attach in clips or slots of each extension.

D. Barbed Wire and Tension Wire: Install wire per manufacturer's instructions.

E. Protect surfaces from damage until Certification of Substantial Completion date. Replace components damaged prior to Certificate of Substantial Completion date.

END OF SECTION

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and General Provisions of Contract, including General and Supplementary Conditions and other Division 1 Specifications, apply to this Section.

B. Related sections:

1. Section 03200: Concrete Reinforcing.
2. Section 03300: Cast-in-Place Concrete.

1.2 DESCRIPTION

A. Design Criteria:

1. Design of formwork shall be by a professional engineer registered in the State of Georgia
2. Design, erect, support, brace and maintain formwork so that it will support vertical and lateral loads imposed during concreting operation until such loads can be supported by the concrete structure itself.
3 Support form facing material using members sized and spaced to prevent deflection of form face and to provide successive form units with continuous surface support.
4. Formwork shall be readily removable without impact, shock or damage to cast-in-place surface and adjacent work.
5. Formwork shall have tight joints to prevent leakage of cement paste during concreting. Butt joints and provide backup material to prevent leakage and fins.
6. Side forms of foundations may be omitted if soil conditions are stable and soil has been excavated to exact footing dimension.

B. Responsibility: The Contractor shall be responsible for furnishing, erecting and maintaining formwork to support loads and to achieve dimensions and surface correctness specified, as well as for removal of formwork to ensure complete safety of the structure.

C. Industry Standards and Reference Specifications:

1. American Concrete Institute (ACI):

ACI 301	Specifications for Structural Concrete for Buildings.
ACI 347R	Guide to Formwork for Concrete
ACI SP-4	Formwork for Concrete (Latest Edition)

2. American Society for Testing and Materials (ASTM):

ASTM A307	Specifications for Carbon Steel Externally Threaded Standard Fasteners
ASTM D 1751	Specifications for Expansion Joint Fillers for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)

D. Allowable Tolerances: Formwork shall be in accordance with ACI 347.
E. Provide Engineering Survey services to check:
1. Lines and levels of completed formwork.
2. Such conditions during concreting to see that they are maintained.

1.3 SUBMITTALS

A. Samples:
1. 1 of each type of form tie and accessory.
2. 1 representative sample of each type of form liner.
B. Shop Drawings:
1. Form drawings showing dimensioned locations of sleeves, openings and inserts as required for all portions of the work.
C. Manufacturer's Standard Instructions on using proprietary items amended to comply with provisions of this Project. The term "manufacturer's instructions" used in this section refers to this submittal unless otherwise noted. This submittal shall include the following:
1. Form ties and accessories.
2. Form releasing agent.

1.4 JOB CONDITIONS

A. Provisions for Other Work:
1. Provide in formwork for openings to accommodate all portions of the work.
2. Size and locate openings, recesses and chases for built-in items in forms in accord with instructions of supplier of such items.
B. Inspect formwork and its shoring and bracing before concreting operations begin to see that shores, braces, ties and accessories are in place and secure.
C. Inspect formwork during concreting operations to verify that form supports and braces have maintained forms in positions to produce concrete within tolerances specified.

PART 2 PRODUCTS

2.1 FORMWORK MATERIAL

A. Formwork shall be plywood, metal, fiberglass or paper acceptable to the Architect.

1. Wood:
a. Plywood: PS-1, "BB (Concrete Form) Plywood:, Class 1, Exterior Grade, mill-oiled and edge sealed. Plywood shall be used in all formwork.

2.2 ACCESSORIES

A. Form Ties: Standard snap-ties shall be used.
B. Corner Forms (chamfers): 45 deg. PVC, or rubber, with 1/2" sides to produce uniform smooth exterior corners and tight edge joints.
C. Rustication, Reglets and Mouldings: As detailed on the Drawings.
D. Form coating shall not stain or soften concrete, shall serve as parting compound or chemical releasing agent to prevent concrete from sticking to forms, and shall act as sealer or protective coating for form.
E. Fastenings and anchorage items for anchoring masonry, nailers and bumpers to concrete shall be:
1. Hanger Inserts: Malleable iron, integral loop at back threaded or slotted for attachment of

hanger type used.

2. Shelf Angle Inserts: Malleable iron with integral loop at back and slotted for wedge head bolt. Size and locations to be as indicated complete with bolts, nuts and washer.
3. Gang Inserts: Continuous slotted inserts for horizontal or vertical bolting with minimum thickness of 3/16" and anchors at 6" intervals on each side.
4. Anchor Bolts: For nailer or similar wood items: Bent or square headed bolts or size and length indicated with washers and square or hexagonal nuts, in accord with ASTM A 307.

F. Expansion Joint Filler: Not less than 1/2" thick, full depth of slab and in accord with ASTM D1751.

G. Sleeves: Schedule 40 steel through masonry walls.

PART 3 EXECUTION

3.1 FORM CONSTRUCTION

A. Formwork shall comply with ACI 301, 347, SP-4 and the "Quality Criteria" specified.

B. Construct forms to shape, lines, grades and dimensions indicated.

C. Earth Forms: Foundation sides, trench walls and similar forms may be earth if soil permits; otherwise, forms shall be used. When earth is used as side form, install plastic membrane over earth before concrete is placed; maintain in position during placing operations. Plastic membrane is not required in foundation excavations where concrete thickness is greater than 12".

D. Center supporting foundations under walls they are to support unless indicated otherwise.

E. Build bulkheads with keys in footings and slabs where placing of concrete is discontinued.

F. Location of construction joints not indicated on the Drawings shall be submitted to Architect for review before placing concrete.

G. Clean form surfaces of dirt, debris and foreign matter before use.

H. Sleeves:

1. Extend through construction where required.
2. Sleeves shall be placed in accordance with details and notes on the Drawings.

3.2 FORM COATING

A. Before placing reinforcement, cover faces of forms in contact with concrete with form coating specified in accord with manufacturer's instructions.

3.3 MISCELLANEOUS BUILT-IN ITEMS

A. Unless otherwise indicated, place 1/2" thick expansion joint fillers full depth of slab where slabs supported on earth abut walls, columns, curbs or other vertical surfaces. Use an adhesive, no nails, to attach expansion joint material to previously placed material, and to surface to receive fresh concrete.

B. Under slabs on ground and over other granular material, place membrane unless noted otherwise on the Drawings. Preparation shall consist of compacting and smoothing sub-grade. Place membrane with minimum of 6" laps in direction of placing concrete. Where expansion joint filler occurs, turn up edge of member at least 6" at vertical surface and place expansion joint filler on top of membrane.

C. Place and secure fastenings and anchorage items, sleeves, openings and similar items of whatever nature in forms before concrete is placed. Such placement shall not interfere with normal position of reinforcement.

3.4 REMOVAL OF FORMS

A. Forms shall be removed so as to insure the complete safety of the structure. The Contractor shall assume responsibility of removal of formwork.

B. Vertical forms for concrete which do not span between definite supports may be removed after a period of two (2) cumulative days during which the temperature of the concrete is 50 degrees F. or above, providing the concrete will not be injured thereby and curing is continued in accordance with CONCRETE FINISHES Section.

C. Cleanup: At completion of concrete work, remove temporary forms from site. Wood shall not be buried in fill or left in contact with earth.

3.5 RE-USE OF FORMS

A. Clean and repair surfaces of forms that are to be reused.

B. Split, frayed, delaminated, patched or otherwise damaged form facing material will not be acceptable.

C. Apply new form coating to concrete contact form surfaces as specified above before re-use.

END OF SECTION

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and other Division 1 Specifications, apply to this Section.

B. Related sections:

1. Section 03100: Concrete Forms.

2. Section 03300: Cast-in-Place Concrete.

3. Section 03600: Concrete Finishes.

1.2 DESCRIPTION

A. Mill Verification Test:

1. One mill test for each 15 tons or less of reinforcing steel shipped to job will be required.

2. Test shall certify that materials shipped meet requirements of ASTM Specifications listed.

3. Cost of testing shall be borne by Contractor.

B. Products furnished under this section shall be of domestic origin and manufacturer.

C. Industry Standards and Reference Specifications:

1. American Concrete Institute (ACI):

a. ACI 301 - Structural Concrete for Buildings.

b. ACI 315 - Details and Detailing of Concrete Reinforcing.

c. ACI 318 - Building Code Requirements for Structural Concrete.

2. American Society for Testing and Materials (ASTM):

a. ASTM A185 - Specification for Welded Steel Fabric for Concrete Reinforcement

b. ASTM A615 -Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.

3. Concrete Reinforcing Steel Institute (CRSI):

a. Manual of Standard Practice.

b. Reinforcement: Anchorage, Lap Splices and Connections.

c. Placing Reinforcing Bars.

4. American Welding Society (AWS):

   a. D1.1 - Structural Welding Code, Steel.

   b. D1.4 – Structural Welding Code, Reinforcing Steel.

D. Allowable Tolerances

1. Concrete cover to formed surfaces: 1/4" + or -.

2. Minimum spacing between bars: 1/4" + or -.

3. Concrete cover to top bars of beams:

   a. Members 8" deep or less: 1/4" + or -.

   b. Members over 8" deep, but not over 24": 3/4" + or -.

   c. Members over 24" deep: 1" + or -.

4. Lengthwise of members: 2" + or -.

1.3 SUBMITTALS

A. Samples:

1. Bar Supports - one of each type, 12" length of continuous type.

2. Splice Devices - one of each type, with manufacturer's installation instructions.

B. Certification of Mill Verification Test specified with test results. Submit 2 copies of each test report, to the Architect for review.

C. Shop Drawings giving complete fabrication, bending and placement of reinforcing. Comply with CRSI Manual and ACI 315, and indicate bar schedules, giving bar sizes, dimensions, and splicing details, stirrup spacing, diagrams of bent bars, and other arrangements and assemblies, as indicated. Schedule shall be shown on drawings. Detail walls in elevation. Coordinate with form drawings showing sleeves, openings and inserts.

1.4 JOB CONDITIONS

A. Deliver reinforcement to project site bundled, tagged and marked. Use metal tags, and indicate bar size, lengths and other information corresponding to designations shown on placement drawings.

B. Store reinforcement materials at site to prevent damage and accumulation of dire or excessive rust.

C. This work shall be coordinated with mechanical and electrical work which is also buried in concrete so that interferences are resolved without impairing the structural integrity and utility of services leaving and/or entering slabs at points indicated.

D. Inspect job for conditions which would prevent execution of this work as specified. Do not proceed until such conditions are corrected.

PART 2 PRODUCTS

2.1 BARS AND WIRE

A. Deformed Reinforcing Steel:

1. All reinforcing bars: ASTM A 615, Grade 60.

B. Tie Wire: 16 gage or heavier, black annealed, except where otherwise specified.

C. Welded Wire Fabric: ASTM A 185. Provide in flat sheets.

2.2 SUPPORT DEVICES

A. Comply with CRSI Manual and ACI 315.

B. Class E at exposed surfaces and Class A otherwise.

C. High chairs (HC) exceeding 3" shall be special high chair (SHC) having tied or cross-laced legs.

D. Combination slab bolsters and high chairs (CSHC) or continuous high chairs (CHC) shall not be used.

E. Supports over granular waterproofing or membrane shall have sand plates.

F. Supports for bottom bars in foundations and slabs on ground shall be solid block of concrete or chairs with sand plates. Top bars shall be supported and E. above.

G. Support bars for top reinforcement shall be #3 minimum with accessories.

H. Extend top reinforcement to support stirrups or provide #4 support bar.

2.3 FABRICATION

A. In accordance with Industry Standard, ACI 315 and CRSI Manual.

B. Fabricate bars to shapes and dimensions indicated within specified tolerances.

C. Bars shall be bent cold.

D. No field bending will be permitted unless specifically shown on the Drawings.

PART 3 EXECUTION

3.1 PLACEMENT

A. Clean reinforcing bars to remove loose rust and mill scale, earth, ice and other materials.

B. Place reinforcement and support in accord with CRSI Manual and ACI 315.

C. Support and tie reinforcing to prevent its displacement by construction loads or placement of concrete.

D. Move to avoid interference with other reinforcing steel, conduits or bedded items; however, maintain total quality of reinforcement, concrete cover and tolerances. Do not field cut reinforcement unless approved by Architect.

3.2 BAR SUPPORTS

A. Provide support at intervals to carry reinforcing and maintain position during concreting.

3.3 CONCRETE COVER

A. Reinforcing shall be secured in position to allow the following concrete cover unless shown otherwise on the Drawings.

Footings	3" clear to bottom and 2" clear to top and sides
Slabs on Grade	2" clear to top, 2" clear bottom
Walls	2" clear, surfaces exposed to weather or earth; 1" clear interior surfaces
Beams	2" clear to principal reinforcement all around

3.4 SPLICES

A. Splices in reinforcement not shown on the Drawings, or not as specified herein shall not be made.

B. Splices shall not be made at point of maximum stress.

C. Lap shall transfer stresses between bars.

D. Temperature bars in walls shall be spliced by using ACI Class B splice.

E. Splices in temperature reinforcement shall be staggered.

3.5 FABRIC

A. Place fabric in top of slabs on grade and in other locations as may be indicated using accessories with support bars at 3'-0" each way.

B. Lap joints 2 wire spacings, but not less than 6".

C. Extend fabric to within 2" of sides and ends of slabs.

3.6 CLEANUP

A. Upon completion of the placing of reinforcement, conduit, sleeves, inserts and other items to be embedded in the concrete remove extraneous materials, rubbish and other foreign matter from forms.

3.7 FIELD OBSERVATION

A. The Architect shall be notified, at least 24 hours ahead of placement of concrete of when reinforcement, conduct, sleeves, inserts and other items to be embedded in the concrete are to be in place so that these items may be observed prior to concreting.

END OF SECTION

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and other Division 1 Specifications, apply to this Section.

B. Related sections:

1. Section 03100: Concrete Forms.

2. Section 03200: Concrete Reinforcing.

3. Section 03600: Concrete Finishes.

1.2 DESCRIPTION

A. Industry Standards and Reference Specifications.

1. American Concrete Institute (ACI):

ACI 211.1	Standard Practice for Selecting Proportions for Normal, Heavyweight and Mass Concrete
ACI 301	Specifications for Structural Concrete for Buildings
ACI 304R	Guide for Measuring, Mixing, Transporting and Placing Concrete
ACI 305R	Hot Weather Concreting
ACI 306R	Cold Weather Concreting
ACI 309R	Guide for Consolidation of Concrete
ACI-318	Building Code Requirements for Structural Concrete

2. American Society for Testing and Materials (ASTM):

ASTM C31	Practice for Making and Curing Concrete Test Specimens in the Field
ASTM C33	Specification for Concrete Aggregates
ASTM C39	Test Method for Compressive Strength of Cylindrical Concrete Specimens
ASTM C42	Test Method for Obtaining and Testing Drilled Cores and Sawed Beans of Concrete
ASTM C94	Specification for Ready-Mix Concrete

ASTM C143	Testing for Slump of Hydraulic Cement Concrete
ASTM C150	Specifications for Portland Cement
ASTM C172	Practice for Sampling Freshly Mixed Concrete
ASTM C192	Practice for Making and Curing Concrete Test Specimens in the Laboratory
ASTM C260	Specification for Air-Entraining Admixtures for Concrete
ASTM C494	Specifications for Chemical Admixtures for Concrete
ASTM C496	Test Method for Splitting Tensile Strength of Cylindrical Concrete Specimens
ASTM E329	Specification for Agencies Engaged in the Testing and/or Inspection of Materials Used in Construction

B. Mix Designs:

1. Testing for Mix Design, submitted by Contractor:

a. Verify testing for mix designs and test of aggregate shall be done by an acceptable independent testing laboratory, complying with ASTM E329 and at the expense of the Contractor in compliance with ACI 318, Article 5.3 and 5.4.

1) Secure and deliver to laboratory preliminary representative samples of materials he proposes to use and which are required to be tested.

2) Supply wheelbarrows, shovels, mixing boards and shaded work space for field testing of concrete and moulding test cylinders in the field.

3) Submit samples for each mix verification, of concrete materials to be used on the Project.

4) Laboratory shall make strength tests for trial batches, using proposed materials and mix designs.

5) Trial batches shall also be verified by laboratory as to strength and workability under field conditions.

6) Verification tests shall take into consideration severe weather concreting conditions.

7) If verification tests fall below the required limits, either the material samples shall be changed and resubmitted or the proposed mix design shall be revised and resubmitted for testing.

8) Compression test specimens made to verify mixes shall be made in accord with ASTM C192. Test aggregates in accord with ASTM C33 and C330 as applicable; test

compression test specimens in accord with ASTM C39.

9) Three copies of all mix verifications, aggregate test results and compression test results shall be sent to the Architect.

2. Mix design from field test data:

a. Mix design from field test data meeting the requirements of ACI 318, Article 5.3 may be submitted in lieu of trial mixtures.

3. Testing for production concrete:

a. The following functions in connection with field testing of concrete shall be performed by laboratory personnel complying with ASTM E329, selected and engaged by, and responsible to the Architect. The testing laboratory shall have the following duties:

1) Inspect the batching plant and file a report with the Architect stating whether the supplier's equipment and methods meet the requirements of these specifications. Inspect the plant and batching during concrete operations as directed by the Architect.

2) Provide stable, insulated storage boxes equipped with controlled heat for storage of acceptance cylinders in first 24 hours after moulding, as required by ASTM C31.

3) Sampling fresh concrete and making compression test specimens in accordance with ASTM C172 and C31 and determining air content in accordance with ASTM C173.

4) Performing test for slump with each sampling of concrete in accordance with ASTM C143.

5) Protecting and initially curing test specimens for first 24 hours.

6) Transporting test specimens to laboratory.

7) Completing field test data sheets prepared in accordance with the Special Inspections Requirements for Field Tests of Concrete and transmitting them to the laboratory. These sheets shall show data on slump test and on all compression test specimens including results of all tests, class of concrete, exact location of pour, air temperature, concrete temperature, date of pour for ready-mixed concrete, designation of test cylinders, date on which designated test cylinders shall be broken and the name and qualification number of the person responsible for performance of field tests of concrete and submission of associated data.

b. The laboratory shall receive, cure and test compressions specimens made during the placing of the concrete. Compression test specimens shall be tested in accordance with ASTM C39. Test reports shall show all pertinent data including class of concrete, exact location of pour, air temperature, concrete temperature, data of pour, truck number used on pour for ready-mixed concrete, date on which specimen was broken, age of the specimen, compression strength of specimen and slump test results of the pour from which the specimen was made.

c. Reports of testing shall be submitted directly as follows: 4 copies to Architect, 1 copy each to Contractor and Ready-Mix Concrete Producer.

d. Test Cylinders: One set of acceptance and field cylinders (total of 4 cylinders) from same batch of concrete shall be made for each 50 cubic yards or fraction thereof for concrete in each day's placing for each class of concrete.

1) Acceptance cylinders (2 cylinders) are compression test cylinders moulded in the field, stored and cured in the field for the first 24 hours after moulding, and thereafter in laboratory until time of testing. Average breaking strength at 28 days of a set of 2 acceptance cylinders shall comprise a test.

2) Field cylinders (2 cylinders) are compression test cylinders moulded in the field, stored and cured on the work site in the same location and subject to the same exposure as job concrete of which they are representative. One field cylinder shall be broken at 3 days and one at 7 days. Time for form removal shall be determined from field test cylinders compressive strength.

e. Contractor's duties relative to Concrete Testing: Use of testing services shall in no way relieve Contractor of his responsibility to furnish materials and construction in full compliance with Contract Documents.

f. Designs and testing because of changes in materials or proportions of mix requested by Contractor, as well as extra testing of concrete or materials occasioned by their failure to meet specified requirements shall be at Contractor's expense.

C. Evaluation of Compression Tests:

1. Evaluation of compression test result shall be as follows:

a. Evaluation of results of tests for concrete shall be according to Chapter 4, Paragraph 4.8.2.3 of ACI 318.

b. Paragraph (a) above is qualified as follows: All compression test of concrete placed in positions of critical structural importance in the building or structure shall not be less than the specified strengths. The Architect's decisions, in identifying positions of critical structural importance in the building and structures shall be final.

2. Failure to comply with the above evaluation procedure shall constitute questionable concrete and additional tests shall be made at no cost to the Owner in accordance with the provisions of Paragraph 4.8.4 of ACI 318. If ultrasonic tests confirmed by core tests fail to demonstrate the strength required by the Contract Documents, then the Architect may, at his discretion, require load tests or remedial measures. Core tests shall be made in accordance with ASTM C42 and load tests shall be made in accordance with Chapter 20 of ACI 318. Acceptability of load tests shall be determined by the criteria of Chapter 20 of ACI 318.

1.3 SUBMITTALS

A. Concrete ingredients to laboratory for verification and aggregates test.

B. Laboratory Reports: 4 copies to Architect and 1 copy each to Contractor and Ready-Mix Concrete Producer, except where otherwise indicated:

1. Verification of Mix Design.

2. Aggregate Test Results.

3. Compression Test Results, as specified.

C. Mill tests on each car of Portland Cement of each marked bin from which cement is shipped.

D. Admixture manufacturer's representative's reports as specified in Paragraph 2.1 C3.

E. Admixture manufacturer's standard instructions amended to comply with provision of this project. The term "manufacturer's instructions" used in this Section refers to this submission unless otherwise noted.

1.4 JOB CONDITIONS

A. Severe Weather Concreting: Unless adequate protection is provided and approval is obtained, concrete shall not be placed during rain sleet or snow. Rain water shall not be allowed to increase mixing water or to damage surface finish.

1. Cold Weather: Provide equipment for heating concrete materials and protecting concrete during freezing or near freezing weather. No frozen materials, or materials containing ice shall be used. Concrete materials and reinforcement, forms, fillers, and ground with which concrete is to come in contact shall be free from frost or ice. Whenever temperature of surrounding air is below 40 degrees, F, concrete placed in forms shall have temperature between 60 degrees F and 70 degrees F and means shall be provided for maintaining temperature of not less than 50 degrees F for 7 days or for more time to insure concrete curing. Salt, Calcium Chloride or other chemicals for prevention of freezing shall not be used. Housing, covering or other protective used in connection with curing shall remain in place and intact for at least 24 hours after artificial heat is discontinued. Follow recommendations of ACI 306.

2. Hot Weather: Provide methods of lowering temperatures of concrete ingredients so that temperature of concrete when placed does not exceed 90 degrees F. When weather is such as to raise concrete temperature as placed consistently above 90 degrees F, use admixture conforming with ASTM C494, Type "D". Sprinkle subgrade and forms with water before placing concrete. Curing shall start as soon as practicable to prevent evaporation of water and forms shall be kept wet. Protect flat work from dry winds, direct sun and high temperatures. Follow recommendations of ACI 305.

B. Scheduling and Sequencing:

1. Do not place slabs on grade until membrane work has been completed.

2. Schedule this work so that no concrete is placed in forms prior to inclusion of reinforcing, anchors, sleeves, conduit and other items indicated to be embedded in concrete forms have been cleaned of foreign matter and Architect has observed the above items in place.

3. Do not place floor faster than available floor finishers can finish before slab sets.

C. Inspect job in accord with provisions of other sections of these specifications for conditions which would prevent execution of this work as specified. Do not proceed until such conditions are corrected.

PART 2 PRODUCTS

2.1 CONCRETE MATERIALS

A. Cement:

1. Cement shall be Portland Cement of American manufacture conforming to ASTM C150, Type 1.

2. Each bag shall weigh 94 pounds and contain one cubic foot.

3. Mill tests shall be taken on each car of cement used, or laboratory tests on marked bin from which cement is shipped. Three copies of each report of tests stating whether the materials meet the requirements of these specifications shall be sent to the Architect.

B. Concrete Aggregates:

1. Fine aggregate shall conform with ASTM C33. Sand shall be clean, hard, durable, uncoated grains and free from deleterious substances.

2. Coarse aggregate for standard weight concrete shall conform with ASTM C33, Class 3M. Aggregate shall be crushed stone, gravel or other approved inert material having clean, hard, durable uncoated particles.

3. The following tabulation shows the conditions of concreting for which maximum size of coarse aggregate shall be used:

No. 57	For all Concrete

C. Admixtures:

1. Water Reducing Admixture: ASTM C494, Type A, D or E to suite placing conditions in accord with manufacturer's instructions.

2. Above admixtures shall be furnished by the same manufacturer, neither owned by nor affiliated with the ready mix concrete producer, who shall have a "representative" to "service" ready mix plant and project site at least once a week for each major concrete placement of 50 or more cubic yards. The "representative" shall file the report, with, 1 copy to the Architect, one copy each direct to Contractor and Ready-mix Plant Manufacturer of each "service", describing his findings, recommendations, and whether or not his recommendations were followed.

3. Admixtures shall contain no chemical in quantities that may have harmful effect on the post-tensioning steel.

4. Air-Entraining admixtures conforming to ASTM C260 shall be used in all exterior concrete except foundation areas to produce 4 to 6% air entrainment.

D. Accessories:

1. Vapor Barrier: ASTM D2103, 10 mil thick clear polyethylene film. Type recommended for below grade application.

E. Water shall be clean, fresh, free from oil, acid organic matter, or other deleterious substances.

2.2 CLASSES OF CONCRETE

A. The location and extent of each class of concrete is specified on the Drawings.
B. Concrete Mixtures:

1. The following tabulations represent minimum cement content and maximum water-cement ratio and in no way imply that the mix will produce the specified minimum 28-day compressive strength for each class.

Class	Type	Max. Water Content US Gal. per 94 lbs. sack of cement	Min. Comp. Strength @ 28-days in.	Min. Sacks of Cement per cubic yard	Slump not to exceed inches
N-4	Normal Weight	5.6	4000	6.5	4
N-5	Normal Weight	*	5000	*	4

*Use Trial Mix or Field Data to establish

C. A water-reducing and set controlling admixture shall be used in all concrete, except concrete for footings.

2.3 PROPORTIONING CONCRETE

A. General:

1. The working stresses for the design of this structure are based on the specified minimum 28-day compressive strength of the concrete.

2. The proportions of aggregate to cement for any concrete shall be such as to produce a mixture which will work readily into the corners and angles of the forms and around reinforcement with the method of placing employed on the work, but without permitting the materials to segregate or excess free water to collect on the surface.

3. All concrete materials shall be measured by weight.

4. All rejected concrete shall be hauled away from the site and disposed of at the Contractor's expense.

5. In interpreting the mixture tables under 2.02B above, aggregate weights must be corrected for moisture and water contained in aggregates which shall be deducted from the total water content given.

6. The combined aggregates shall be of such composition of size that when separated on the No. 4 standard sieve the weight passing the sieve (fine aggregate) shall not be less than 30 percent nor greater than 50 percent of the total.

7. Proportioning shall conform to ACI 211.

2.4 PRODUCTION

A. Mixing shall be achieved by using equipment and methods in accord with provisions of ASTM C94, however, concrete production may be on or off site. Ready mixed concrete purchased from a local producer may be used.

B. Delivery tickets shall be furnished with each load of concrete delivered under this Specification.

C. Ticket shall show class and strength of concrete, number of pounds of cement, size of coarse aggregate, batching time, slump ordered and amount of admixture.

D. Contractor shall keep up with moisture content in the aggregate to determine the need to correct quantities of ingredients for variations in moisture content, and quality control of ingredients delivered to batching plant. However, no mix adjustments to compensate for observed variation of moisture content shall be allowed without prior approval of the Architect.

PART 3 EXECUTION

3.1 CONVEYING

A. Personnel and Equipment: Place concrete employing experienced crew with equipment to place entire panel or section in a continuous unbroken operation from beginning to end. Convey concrete from mixer to place of final deposition by methods which will prevent separation or loss of materials.

B. Chuting or Pumping: Equipment for chuting or other method of conveying concrete shall be of size and design to insure a continuous flow of concrete at delivery point without separation or degradation of materials. Aluminum chutes or pipes shall not be used.

C. Carts or buggies shall be equipped with pneumatic tires.

D. Runway supports shall not bear on reinforcement or on fresh concrete.

E. Conveying equipment shall be in first class operating conditions, cleaned before beginning and cleaned at frequent intervals during placing of concrete.

3.2 PREPARATION OF PLACING

A. Concrete shall not be placed on earth until the fill or excavation has been prepared as set forth under these specifications.

B. Before placing any concrete in forms, all pipes or sleeves, openings or embedded items shall be in place and shall have received tests specified for them.

C. Concrete shall not be placed in forms until all debris, wood shavings and foreign matter have been removed from the forms and the reinforcing steel is in condition for the placement of concrete.

D. Hardened, or partially hardened concrete, or foreign matter on the forms or reinforcement shall be removed before placing concrete.

3.3 PLACING

A. Quality:

1. Deposit concrete as nearly as practicable in its final position to avoid segregation due to rehandling or flowing.

2. Concreting shall be at such rate that concrete is at all times plastic and flows readily into forms. No concrete shall be deposited that has partially hardened or been contaminated by foreign material, nor shall retempered concrete be used.

3. In no case shall concrete be used when elapsed time after addition of water and cement to batch exceed one and one-half hours.

4. Concrete shall not be dropped more than 4 feet without use of metal chutes or tremie pipes.

B. Continuation: When concreting is once started, it shall be carried on as a continuous operation until placing of panel or section is completed. The top surface shall be furnished to a true plane. Camber in forms shall be accounted for to maintain proper member thickness. Construction joints indicated on final accepted placing drawings shall be in accord with provisions in the CONCRETE FORMS Section.

D. Where cement matrix is basis of finish, work coarse aggregate back from forms so as to bring a full surface of matrix against forms, without formation of excessive surface voids. Consolidate concrete by vibration, spading, rodding or forking, so that concrete is worked around reinforcing and tendons, around embedded items and into corners of forms, eliminating air or stone pockets which may cause honeycombing, pitting or planes of weakness. Care shall be exercised to prevent concrete from entering sheathing around tendons or anchorage hardware for tendons. Special care shall be given to vibration of concrete at tendon anchorages to insure uniform compaction at these points. Mechanical vibrators shall be operated by competent workmen. Over vibrating and use of vibrators to transport concrete within forms is not allowed. Vibrators shall be inserted and withdrawn at many points, from 18 to 30 inches apart, for 5 to 15 seconds duration. A spare vibrator shall be kept on job site during concrete placing operations. Follow recommendations of ACI 309.

3.4 CONTROL JOINTS (SLAB ON GRADE)

A. Where control joint is made in slab on grade by saw cutting the slab, the saw cutting shall be done within 4-12 hours after the concrete placement, and ideally as soon as possible without dislodging the aggregate.

3.5 PATCHING

A. Defective Areas: Concrete which is not formed as shown on drawings or for any reason is out of alignment or level or shows a defective surface, or shows defects which reduce structural adequacy of member or members, shall be considered as not conforming with the intent of these specifications and shall be removed from job unless Project Superintendent grants permission to patch defective area.

1. Permission to patch such areas shall not be considered a waiver of Architect's right to require complete removal of defective work if patching does not, in his opinion, satisfactorily restore quality and appearance of surface or structural adequacy of member or members.

B. Method of Patching: If permission to patch defective areas is granted, the patching shall be done immediately after form removal as follows:

1. Defective areas shall be chipped away to a depth of not less than 1" with edges perpendicular to surface. Area to be repaired and an area at least 6" wide surrounding it, shall be dampened to prevent absorption of water from patching mortar. After surface water has evaporated from area to be patched, brush bond coat, as specified below, into surface. Prepare bonding grout using a mix of 1 part cement to 1 part fine sand passing a No. 30 sieve, and mix to consistency of thick cream.

2. Make patching mixture of same material and of same proportions as used for the concrete, except that coarse aggregates shall be omitted and the mortar shall consist of not more than 1 part cement to 2 1/2 parts sand by damp loose volume. White Portland Cement shall be substituted for a part of the gray Portland Cement on exposed concrete in order to produce a color matching the color of the surrounding concrete, as determined by a trial patch.

3. The quantity of mixing water shall be no more than necessary for handling and placing. Mix patching mortar in advance and allow it to stand, giving it frequent manipulations with trowel without adding water, until it has reached stiffish consistency that will permit placing.

4. When bond coat specified above begins to lose the water sheen, apply the premixed patching mortar. Consolidate the mortar into place and strike off so as to leave patch slightly higher than surrounding surface. To permit initial shrinkage, it shall be left undisturbed for at least 1 hour before being finished. Patched area shall be kept damp for 7 days. Metal tools shall be used in finishing a patch in a form wall which will be exposed.

5. Finish patched surfaces to match the adjacent surfaces.

C. Tie Holes: After being cleaned and dampened, fill tie holes solid with patching mortar and finish same as in Paragraph B above.

D. Proprietary Materials: Proprietary compounds for adhesion or as patching ingredients may be used in lieu of or in addition to the foregoing patching procedures. Such compounds shall be used in accordance with the manufacturer's recommendations.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Densification and burnishing of concrete floor slabs.

B. Related Requirements:
1. Section 03300 - Cast-In-Place Concrete. Concrete for interior slabs on grade.

1.2 REFERENCES

A. The publications listed below form a part of this specification to the extent referenced. Publications are referenced within the text by the basic designation only.

B. ASTM International (ASTM):
1. ASTM C1028 - Standard Test Method for Determining the Static Coefficient of Friction (SCOF) of Ceramic Tile and Other Like Surfaces by the Horizontal Dynamometer Pull-Meter Method.
2. ASTM D1455 - Standard Test Method for 60° Specular Gloss of Emulsion Floor Polish

1.3 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Dispense densifier material from factory numbered and sealed drums. Maintain record of drum numbers.

1.4 ENVIRONMENTAL REQUIREMENTS

A. Limit and control damage from excessive dust caused by burnishing.

B. Limit and control damage from moisture. Remove standing moisture from floor after densifier application.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with project requirements, provide products as manufactured by the following to the extent as specified hereinafter for the specific product:
1. 3M St. Paul, MN (888) 364-3577
2. AmeriPolish, Lowell, AR 800-592-9320.
3. Curecrete Chemical Co, Springville, UT (800) 998-5664.
4. Dayton Superior Chemical, Kansas City, KS (866) 329-8724.
5. Diamond Tool Supply, Monroe, MI (734) 243-9900
6. Euclid Chemical Co, Cleveland, OH (877) 438-3826.
7. HTC, Knoxville, TN (877) 482-8700.
8. L&M Construction Chemicals, Omaha, NE (800) 362-3331.
9. Nox-Crete Products Group, Omaha, NE (800) 669-2738.
10. Pioneer Eclipse, Sparta, NC (800) 367-3550.
11. SASE, Kent, WA (800) 522-2606.
12. SpecChem, Kansas City, MO (866) 791-8700
13. Stonekor LLC, Adairsville, GA (800) 633-0519.
14. Substrate Technology, Inc., (815) 941-4800
15. Superior Surface Solutions, Kansas City, MO (888) 471-5227.
16. Vexcon Chemicals, Philadelphia, PA (888) 839-2661.

2.2 DENSIFIER PRODUCTS

A. Pre-Densifier Floor Cleaner: As recommended by densifier manufacturer.

B. Reactive Silicate Densifier:
1. 3D Densifier by AmeriPolish
2. Ashford Formula by Curecrete Chemical.
3. Day-Chem Sure Hard (J-17) by Dayton Superior.
4. Duro-Nox by Nox-Crete.
5. Euco Diamond Hard by Euclid.
6. Seal Hard by L&M Construction Chemicals.
7. SpecHard by SpecChem
8. Starseal PS by Vexcon.

PART 3 - EXECUTION

3.1 PREPARATION

A. Ensure that the correct amount of densifier is onsite and in numbered containers prior to commencement of work.

3.2 INSTALLATION/APPLICATION EQUIPMENT

A. Scrubbing And Burnishing Equipment:
1. Scrubber Machines Equipment used for cleaning operations shall be Clark Encore Max38 or L38 with a head pressure of 150 lbs. or similar equipment as required to produce the specified results.
2. Burnishing Machine: High speed propane burnisher, with a min. 27 inch head generating pad speeds of 1,500 RPM or higher as verified with tachometer.

B. Burnishing Pads: Pads as follows or equivalent as required to produce specified results:
1. Diamond Impregnated Pads:
   a. Scotch-Brite Diamond Floor Pads Plus by 3M.
   b. Shure Shine Pads by SASE
   c. Twister Diamond Cleaning System Pads by HTC.
   d. Vortex Diamond Impregnated Pad (DIP) by Diamond Tool Supply.
2. Natural Hair Pads:
   a. Consolideck Heat Pad by Prosoco.
   b. Niagra Super Hogs Hair Floor Pad 3700N by 3M.
   c. Sure Shine Heat Pads by SASE
   d. Ultra Grizzly Bear by Norton.

C. Sprayer: Manufacturer approved high volume, low pressure sprayer and sprayer tip.

3.3 GENERAL CLEANING AND BURNISHING REQUIREMENTS

A. Coordinate with joint filling operations. Do not perform wet cleaning within 72 hrs prior to joint filling.

B. Clean floors as specified hereinafter prior to application of densifier.

C. Burnish floors as specified hereinafter after application of densifier.

D. Utilize riding machines to the maximum extent practical to achieve optimum efficiency.

3.4 CLEANING

A. Use sweeping compound to control airborne dust. Scrape floor to remove remaining saw cut residue and paint droppings. Remove paint droppings with soft, damp cloth and solvent stripper. Do not use stripper with an acidic pH.

B. Treat oil spots with oil emulsifier and oil absorber materials.

C. Double scrub floor with scrubber machine and appropriate brushes or pads and pH compatible detergent.

3.5 DENSIFIER APPLICATION

A. Area to be Treated: Apply densifier to all interior concrete floors, except floors to receive resilient flooring,unless otherwise shown or scheduled on the drawings.

B. Examination and Preparation:
1. Examine surfaces receiving densifier. Verify that surfaces conform to product manufacturer's requirements for substrate conditions.
2. Vacuum and clean saw cut joints and surrounding area so that no dust remains to react with concrete finish material.
3. Remove remnant of temporary film forming curing compound prior to application of densifier. Remove compound by cleaning and scrubbing in accordance with manufacturer’s instructions.
4. Scrub floor with pre-densifier floor cleaner to remove latent salts.
5. Verify floor is free of curing membrane, bond-breaker, and construction laitance.
6. Do not proceed until unsatisfactory conditions have been corrected.

C. Application:
1. Application shall be performed by certified applicator in accordance with manufacturers published instructions.
2. Schedule to begin 7 to 14 days after floor slab placement.
3. Employ methods to ensure concrete surface is not damaged during application, including discoloration.
4. Apply densifier finish at the rate of 300 square feet maximum per gallon.
5. Apply with low pressure sprayer with enough coverage to keep concrete surface wet for minimum 20 minute period.
6. When treated surface gels and becomes slippery under foot, lightly sprinkle surface with water and agitate with broom to redistribute special concrete finish material evenly across surface.
7. After surface again becomes slippery, using garden hose with garden-type spray nozzle, flush entire surface with water removing excess material, alkali, or impurities. Squeegee or wet-vac surface dry to remove excess material to avoid whitening of concrete during curing. Whitening of concrete by over-application of hardener/densifier may be cause for rejection.
8. Apply second coat of densifier 2 weeks prior to Substantial Completion, apply over surfaces to which densifier has been applied.
9. Apply densifier finish at the rate of 1000 square feet per gallon.
10. Apply with low pressure sprayer with enough coverage to keep concrete surface wet for minimum 20 minute period.

3.6 DISPOSAL

A. Upon completion of each densifier treatment, dispose of excess densifier material as required by local agency having jurisdiction.

B. Certified applicator shall remove all densifier product containers from job site immediately upon completion of work.

3.7 BURNISHING PROCEDURE

A. Allow second coat of densifier to dry.

B. Wet burnish at a slow movement pace using burnishing machine with 800 or higher grit diamond impregnated or hogs hair burnishing pads.

C. Continue wet burnishing operations until the specified gloss is attained. Achieve specified gloss not later than two weeks prior to Substantial Completion and maintain specified gloss levels until Substantial Completion.

D. Do not use any burnishing pad that may damage the concrete slab surface prior to strength development at any given time of the burnishing process. The development of specified gloss values shall be attained through proper densification and mechanical burnishing with the correct specified pads required for the given surface condition.

E. Provide final burnishing prior to Substantial Completion to eliminate any scratches resulting from construction operations.

3.8 FINISH REQUIREMENTS

A. Appearance:
1. Slab surfaces shall have a uniform Class A (Cream), Level 3 (Polished) appearance in accordance with the Concrete Polishing Council (CPC) definitions (https://www.ascconline.org/concrete-polishing-council/glossary).
2. Procedure shall leave no evidence of scratching or streaking from uneven polishing.
3. White residue or hazy appearance in the finished surface will not be accepted.

B. Gloss Values: Measured surface gloss values within the polished concrete (“PC” or otherwise indicated) floor areas shown on the drawings to receive a Gloss shall be between 30 and 55 in accordance with ASTM D1455 as measured using a Horiba IG-320 Gloss Checker at time of project turnover.

3.9 FLOOR PROTECTION

A. Contractor shall protect finished floor in accordance with Section 03300 until time of Substantial Completion.

3.10 FIELD QUALITY CONTROL

A. Field quality control shall be the responsibility of the Contractor in accordance with Section 01400. T&I specified below shall not be considered a substitute for the Contractor’s responsibility to perform similar routine, necessary, and customary testing and inspection of the methods and frequency suitable for the type of work involved.

B. Manufacturer’s Services: A technically qualified manufacturer’s field representative of the densifier product shall be on site during the initial application of the densifier and occasional observations during remainder of the applications.

3.11 TESTING AND INSPECTION (T&I)

A. The Independent Testing Agency (ITA) will perform testing and inspection (T & I) but only as a means to satisfy the Owner of contract compliance and as assurance to the Owner of Contractor quality control performance.

B. T&I specified herein below will be performed by the ITA in accordance with Section 01400.

C. Gloss Measurements:
1. Gloss measurements will be taken two weeks prior to Substantial Completion and at time of Possession. Contractor shall notify ITA when floors are ready for testing.
2. Measurement and Recording:
   a. Measure gloss value at three evenly but randomly distributed locations within each column bay within the floor areas shown on the drawing Finish Plan or Foundation Plan to receive Polished Concrete (PC).
   b. Record measurement locations on copy of Finish Plan or Foundation Plan.
   c. If samples fail to meet the specified value, Contractor shall continue burnishing operations until the specified gloss requirements are achieved.
   d. Record and certify gloss measurements.
3. ITA will prepare test report including plan and table of the measurements. ITA will submit test report to Owner and Architect.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes precast concrete units in the following applications:
   1. Sill.

1.2 REFERENCES

A. The publications listed below form a part of this specification to the extent referenced. Publications are referenced within the text by the basic designation only.

B. ASTM International (ASTM):
   1. ASTM A 82 – Steel Wire, Plain, for Concrete Reinforcement.
   2. ASTM A 615 – Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
   3. ASTM A 496 – Steel Wire, Deformed for Concrete Reinforcement.
   4. ASTM C 33 – Concrete Aggregates
   5. ASTM C 144 – Aggregate for Masonry Mortar
   6. ASTM C 150 – Portland Cement
   7. ASTM C 260 – Air-Entraining Admixtures for Concrete

C. American Concrete Institute (ACI):
   1. ACI 211.1 – Standard Practice for Selecting proportions for Normal, Heavyweight and Mass Concrete.
   2. ACI 318 – Building Code Requirements for Structural Concrete.

D. Concrete Reinforcing Steel Institute (CRSI):
   1. CRSI – Manual of Standard Practice

E. Precast / Prestressed Concrete Institute (PCI):
   1. PCI MNL 120 – Design Handbook – Precast and Prestressed Concrete
   2. PCI MNL 117 – Manual for Quality Control for Plants and Production of Architectural Precast Concrete Products.

1.3 QUALITY ASSURANCE

A. Design Standards: Comply with ACI 318 and the design recommendations in PCI MNL 120.

B. Quality-Control Standard: Comply with PCI MNL 117.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Store units at Project site to prevent cracking, distorting, warping, staining, or other physical damage, and so markings are visible.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Steel Reinforcing:
   1. Reinforcing Bars: ASTM A 615, Grade 60, deformed.
   2. Plain-Steel Wire: ASTM A 82, as drawn.

3. Deformed-Steel Wire: ASTM A 496.

B. Concrete: Portland Cement: ASTM C 150, Type I or Type III of same type, brand, and source.

C. Aggregate: Normal-Weight Aggregates: Except as modified by PCI MNL 117, ASTM C 33, with coarse aggregates complying with Class 5S.

D. Air-Entraining Admixture: ASTM C 260.

E. Sand-Cement Grout: Portland cement, ASTM C 150, Type I, and clean, natural sand, ASTM C 144. Mix at ratio of 1 part cement to 2-1/2 parts sand, by volume, with minimum water required for placement and hydration.

2.2 CONCRETE MIXES

A. Proportion mixes by either laboratory trial batch or field test data methods according to ACI 211.1, with materials to be used on Project, to provide normal-weight concrete with the following properties:
1. Compressive Strength (28 Days): 5000 psi.
2. Maximum Water-Cementitious Materials Ratio: 0.45.

B. Water Absorption: 12 to 14 percent by volume, tested according to PCI MNL 117.

C. Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having an air content complying with PCI MNL 117.

2.3 FABRICATION

A. Cast concrete units in size and shape as indicted.

B. Reinforcement: Comply with recommendations in CRSI's "Manual of Standard Practice" and PCI MNL 117 for fabricating, placing, and supporting reinforcement.

C. Reinforce precast architectural concrete units to resist handling, transportation, and erection stresses.

D. Mix concrete according to PCI MNL 117 and requirements in this Section. After concrete batching, no additional water may be added.

E. Thoroughly consolidate placed concrete by internal and external vibration without dislocating or damaging reinforcement and built-in items. Use equipment and procedures complying with PCI MNL 117.

F. Cure concrete, according to requirements in PCI MNL 117, by moisture retention without heat or by accelerated heat curing using low-pressure live steam or radiant heat and moisture.

G. Discard precast architectural concrete units that are warped, cracked, broken, spalled, stained, or otherwise defective unless repairs are approved by Architect.

H. Fabricate precast architectural concrete units straight and true to size and shape with exposed edges and corners precise and true so each finished panel complies with PCI MNL 117 product tolerances as well as position tolerances for cast-in items.

I. Fabricate sill in nominal dimensions, allowing for 3/8 inch mortar joints.

2.4 FINISHES

A. Finish exposed surfaces of precast architectural concrete units to a smooth surface finish free of pockets, sand streaks, and honeycombs, with uniform color and texture. Chamfer exposed edges of sills.

2.5 SOURCE QUALITY CONTROL

A. Quality-Control Testing: Test and inspect precast concrete according to PCI MNL 117 requirements.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Lay units with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not slush head joints. Remove excess mortar.

B. Dowel units into place as shown on the Drawings.

C. Maintain courses to uniform width. Align vertical joints. Provide joints equal and of uniform thickness.

D. Tool head and bed joints concave. Use tool with large enough radius that joint is not raked free of mortar.

E. Install precast architectural concrete units level, plumb, square, true, and in alignment without exceeding the non-cumulative erection tolerances of PCI MNL 117, Appendix I.

F. Seal sill units as shown in accordance with Section 07901 with sealant color to match mortar.

G. Clean exposed surfaces of precast concrete units after erection to remove markings, dirt, and stains.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes glass-fiber-reinforced concrete (GFRC) panels consisting of GFRC, panel frames, anchors, and connection hardware.

B. GFRC panels include cornices.

C. Related Sections include the following:
1. Concrete
2. Structural Steel Framing
3. Joint Sealants

D. Definitions: Design Reference Sample: Sample of approved GFRC color, finish, and texture preapproved by Architect.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at [**Project site**] <**Insert location**>.

1.3 PREFORMANCE REQUIREMENTS

A. Delegated Design: Engage a registered professional engineer in the state of Georgia, to design GFRC.

B. Structural Performance: Provide GFRC panels, including panel frames, anchors, and connections, capable of withstanding the following design loads as well as the effects of thermal- and moisture-induced volume changes according to load factors and combinations established in PCI MNL 128, “Recommended Practice for Glass Fiver Reinforced Concrete Panel.”
1. Dead Loads: As indicated on the drawings.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated in PART 1 and /or shown on the Drawings. Include GFRC design mixes.

B. Shop Drawings: Show fabrication and installation details for GFRC panels including the following:
1. Panel elevations, sections, and dimensions.
2. Thickness of facing mix, GFRC backing, and bonding pads for typical panels.
3. Finishes.
4. Joint and connection details.
5. Erection details.
6. Panel frame details for typical panels including sizes, spacings, thicknesses, and yield strengths of various members.
7. Locations and details of connection hardware attached to structure.
8. Sizes, locations, and details of flex, gravity, and seismic anchors for typical panels.
9. Other items sprayed into panels.
10. Erection sequence for special conditions.
11. Relationship to adjacent materials.

12. Description of loose, cast-in, and field hardware.

C. Samples: Representative of finished exposed face of GFRC showing a full range of colors and texture expected, approximately 16 by 16 inches and of actual thickness.

D. Welding certificates.

E. Steel sheet certification. For steel sheet used in cold-formed steel panel framing.

F. Mill Certificates: For structural-steel shapes and hollow structural sections used in panel framing.

G. Qualification Data: For GFRC manufacturer including proof of current PCI Plant Certification.

H. Source Quality-Control Program: For GFRC manufacturer.

I. Source Quality-Control Test Reports: For GFRC, inserts, and anchors.

J. Research/evaluation reports: For GFRC, PCI's ICBO Evaluation Report #4359

K. Delegated-Design Submittal: For GFRC to comply with performance requirements and design criteria, including analysis data signed and sealed by the registered professional engineer responsible for their preparation.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: A qualified manufacturer who participates in PCI's Plant Certification Program and is designated a PCI-certified plant for Group G - Glass Fiber Reinforced Concrete.

1. Manufacturer's responsibility includes fabricating [and installing] GFRC panel and providing professional engineering services needed to assume engineering responsibility for GFRC panels.
2. Engineering responsibility includes preparation of Shop Drawings and comprehensive engineering analysis, based on GFRC production test values, by a qualified professional engineer experienced in GFRC design.

B. Steel Sheet Certifications: Obtain mill certificates, signed by manufacturers of steel sheet or test reports from a qualified testing agency indicating steel sheet used in cold-formed metal panel framing complies with requirements including uncoated steel thickness, yield strength tensile total elongation, chemical requirements and galvanized-coating thickness.

C. Mill Certificates: Obtain certified mill test for manufacturer of structural steel shapes and hollow structural sections used in panel framing indicating compliance of these products with requirements

D. Source Limitations: Obtain GFRC panels from single source from single manufacturer.

E. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel," and AWS D1.3/D1.3M, "Structural Welding Code - Sheet Steel."

F. PCI Manuals: Comply with requirements and recommendations in the following PCI manuals unless more stringent requirements are indicated:
1. PCI MNL 128, "Recommended Practice for Glass Fiber Reinforced Concrete Panels."
2. PCI MNL 130, "Manual for Quality Control for Plants and Production of Glass Fiber Reinforced Concrete Products."

G. AISI Specifications: Comply with AISI's "Specification for the Design of Cold-Formed Steel Structural Members."

H. AISC Specifications: Comply with AISC's "Specification for Structural Steel Buildings – Allowable Stress for Plastic Design"

I. Mockups: Build mockups to demonstrate aesthetic effects and to set quality standards for fabrication and installation.
   1. Build mockup of typical wall area as shown on Drawings as part of building.
   2. Mockup shall include joint sealants and metal flashing.
   3. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Handle and transport GFRC panels supported on nonstaining material and with nonstaining resilient spacers between panels.

B. Store GFRC panels off of ground on firm, level, and smooth surfaces supported on nonstaining material and with nonstaining resilient spacers between panels. Place stored panels so identification marks are clearly visible.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acceptable 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. Clark Pacific.
   2. David Kucera, Inc
   3. Forterra Structural Precast
   4. GFRC Cladding Systems, Inc
   5. Walters & Wolf Precast

B. Source Limitations: Obtain GFRC panels from single source from single manufacturer.

2.2 MOLD MATERIALS

A. Molds: Rigid, dimensionally stable, non-absorptive material, warp and buckle free, that provides continuous GFRC surfaces within tolerances; nonreactive with GFRC and capable of producing required finish surfaces.
   1. Mold-Release Agent: Commercially produced liquid-release agent that does not bond with, stain, or adversely affect GFRC surfaces and does not impair subsequent surface or joint treatments of GFRC.

B. Form Liners: Units of face design, texture, arrangement, and configuration indicated. Provide solid backing and form supports to ensure that form liners remain in place during GFRC application. Use with manufacturer's recommended liquid-release agent that does not bond with, stain, or adversely affect GFRC surfaces and does not impair subsequent surface or joint treatments of GFRC.

C. Surface Retarder: Chemical liquid-set retarder capable of temporarily delaying hardening of newly placed GFRC face mix to depth of reveal specified.

2.3 GFRC MATERIALS

A. Portland Cement: ASTM C 150/C 150M; Type I, II, or III.
   1. For surfaces exposed to view in finished structure, use white of same type, brand, and source throughout GFRC production.

B. Metakaolin: ASTM C 618, Class N.

C. Glass Fibers: Alkali resistant, with a minimum zirconia content of 16 percent, 1 to 2 inches long, specifically produced for use in GFRC, and complying with PCI MNL 130.

D. Sand: Washed and dried silica, complying with composition requirements in ASTM C 144; passing a No. 20 sieve with a maximum of 2 percent passing a No. 100 sieve.

E. Facing Aggregate: ASTM C 33/C 33M, except for gradation, and PCI MNL 130, 1/4-inch (6- mm) maximum size.
   1. Aggregates shall be selected by Architect. Aggregates shall be hard, and durable; free of material that reacts with cement or causes staining; to match sample.

F. Coloring Admixture: ASTM C 979/C 979M, synthetic mineral-oxide pigments or colored water-reducing admixtures, temperature stable, nonfading, and alkali resistant.

G. Water: Potable; free from deleterious material that may affect color stability, setting, or strength of GFRC and complying with chemical limits in PCI MNL 130.

H. Polymer-Curing Admixture: Acrylic thermoplastic copolymer dispersion complying with PCI MNL 130.

I. Air-Entraining Admixture: ASTM C 260/C 260M, containing not more than 0.1 percent chloride ions.

J. Chemical Admixtures: ASTM C 494/C 494M, containing not more than 0.1 percent chloride ions.

2.4 ANCHORS, CONNECTORS, AND MISCELLANEOUS MATERIALS

A. Carbon-Steel Shapes and Plates: ASTM A 36/A 36M, finished as follows:

   1. Finish: Zinc coated by hot-dip process according to ASTM A 123/A 123M, after fabrication, or ASTM A 153/A 153M, as applicable.

B. Malleable-Iron Castings: ASTM A 47/ A 47M, Grade 32510

C. Bolts: ASTM A 307 or ASTM A 325 finished as follows:

   1. Finish: Zinc coated by hot-dip process according to ASTM A 123/A 123M, after fabrication, and ASTM A 153/A 153M, as applicable.

2.5 PANEL FRAME MATERIALS

A. Cold-Formed Steel Framing: Manufacturer's standard C-shaped steel studs, complying with AISI's "Specification for the Design of Cold-Formed Steel Structural Members," with minimum uncoated steel thickness of 0.0538 inch of web depth; with stiffened flanges, U-shaped steel track;

and of the following steel sheet:

1. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, structural-steel sheet, G60 zinc coating, of grade required by structural performance of framing.

B. Hollow Structural Sections: Steel tubing, ASTM A 500/A 500M, Grade B, or ASTM A 513, finished as follows:

1. Finish: Shop primed with organic zinc-rich primer complying with SSPC-Paint 20 on surfaces prepared to comply with SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."

C. Steel Channels and Angles: ASTM A 36/A 36M, finished as follows:

1. Finish: Shop primed with organic zinc-rich primer complying with SSPC-Paint 20 on surfaces prepared to comply with SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."

2.6 GFRC MIXES

A. Mist Coat: Portland cement, sand slurry, and admixtures; of same proportions as backing mix without glass fibers.

B. Face Mix: Proportion face mix of portland cement, sand, facing aggregates, and admixtures to comply with design requirements.

C. Backing Mix: Proportion backing mix of portland cement, glass fibers, sand, and admixtures to comply with design requirements. Provide nominal glass-fiber content of not less than 5 percent by weight of total mix.

D. Polymer-Curing Admixture: 6 to 7 percent by weight of polymer-curing admixture solids to dry portland cement.

E. Air Content: 8 to 10 percent; ASTM C 185.

F. Coloring Admixture: Not to exceed 10 percent of cement weight.

2.7 PANEL FRAME FABRICATION

A. Fabricate panel frames and accessories plumb, square, true to line, and with components securely fastened according to Shop Drawings and requirement in this Section.

1. Fabricate panel frames using jigs or templates.
2. Cut cold-formed metal framing members by sawing or shearing; do not torch cut.
3. Fasten cold-formed metal framing members by welding. Comply with AWS D1.3 requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
4. Fasten framing members of hollow structural sections, steel channels, or steel angles by welding. Comply with AWS D1.1 requirements and procedure for welding, appearance and quality of welds, and methods used in correcting welding work.
5. Weld flex, gravity, and seismic anchors to panel frames.

B. Reinforce stiffen and brace framing assemblies, as necessary, to withstand handling, delivery, and erection stresses. Lift fabricated assemblies in a manner that prevents damage or significant distortion.

C. Galvanizing Repair: Touch up damaged galvanized surfaces according to ASTM A 780/A 780M.

D. Painting Repair: Touch up damaged painted surfaces using same primer.

2.8 MOLD FABRICATION

A. Construct molds that result in finished GFRC complying with profiles, dimensions, and tolerances indicated, without damaging GFRC during stripping.
   1. Construct molds to prevent water leakage and loss of cement paste.
   2. Coat contact surfaces of molds with form-release agent.

B. Place form liners accurately to provide finished surface texture indicated. Provide solid backing and supports to maintain stability of liners during GFRC application. Coat form liner with form- release agent.

C. Locate, place, and secure flashing reglets accurately.

2.9 GFRC FABRICATION

A. Proportioning and Mixing: For backing mix, meter sand/cement slurry and glass fibers to spray head at rates to achieve design mix proportions and glass-fiber content according to PCI MNL 130 procedures.

B. Spray Application: Comply with general procedures as follows:
   1. Spray or place face mix in thickness indicated on Shop Drawings.
   2. Proceed with spraying backing mix before face mix and/or mist coat has set, using procedures that produce a uniform thickness and even distribution of glass fibers and matrix.
   3. Consolidate backing mix by rolling or other technique to achieve complete encapsulation of glass fibers and compaction.
   4. Measure thickness with a pin gage or other acceptable method at least once for every 5 sq. ft. of panel surface. Take no fewer than six measurements per panel.

C. Hand form and consolidate intricate details, incorporate formers or infill materials, and overspray before material reaches initial set to ensure complete bonding.

D. Attach panel frame to GFRC before initial set of GFRC backing, maintaining a minimum clearance of 1/2 inch from GFRC backing, and without anchors protruding into GFRC backing.

E. Build up homogeneous GFRC bonding pads over anchor feet, maintaining a minimum thickness of 1/2 inch over tops of anchor feet, before initial set of GFRC backing.

F. Inserts and Embedments: Build up homogeneous GFRC bosses or bonding pads over inserts and embedments to provide enough anchorage and embedment to comply with design requirements.

G. Curing: Employ initial curing method that ensures sufficient strength for removing units from mold. Comply with PCI MNL 130 procedures.

   1. After initial curing, remove panel from mold and place in a controlled curing environment.
   2. Keep GFRC panels continuously moist for a period of seven days unless polymer admixtures was used. Maintain temperature between 60 and 120 deg F during this period.

H. Panel Identification: Mark each GFRC panel to correspond with identification mark on Shop Drawings. Mark each panel with its casting date.

2.10 FABRICATION TOLERANCES

A. Manufacturing Tolerances: Manufacture GFRC panels so each finished unit complies with PCI MNL 130 for dimension, position, and tolerances.

B. Manufacturing Tolerances: Manufacture GFRC panels so each finished unit complies with the following dimensional tolerances. For dimensional tolerances not listed below, comply with PCI MNL 130.

C. Position Tolerances: Measured from datum line locations, as indicated on Shop Drawings.
1. Panel Frame and Track: Plus or minus 1/4 inch.
2. Flashing Reglets at Edge of Panel: Plus or minus 1/4 inch.
3. Inserts: Plus or minus 1/2 inch.
4. Special Handling Devices: Plus or minus 3 inches.
5. Location of Bearing Devices: Plus or minus 1/4 inch.
6. Blockouts: Plus or minus 3/8 inch.

D. Panel Frame Tolerances: As follows:
1. Vertical and Horizontal Alignment: 1/4 inch per 10 feet.
2. Spacing of Framing Member: Plus or minus 3/8 inch.
3. Squareness of Frame: Difference in length of diagonals of 3/8 inch.
4. Overall Size of Frame: Plus or minus 3/8 inch.

2.11 FINISHES

A. Finish exposed-face surfaces of GFRC to match approved **design reference sample** and **mockups** Panel faces shall be free of joint marks, grain, and other obvious defects.
1. Smooth surface finish: Provide free of sand streaks, honeycombs, and excessive air voids, with uniform color and texture.

2.12 SOURCE QUALITY CONTROL

A. Quality-Control Testing: Establish and maintain a quality-control program for manufacturing GFRC panels according to PCI MNL 130.
1. Test materials and inspect production techniques.
2. Quality-control program shall monitor glass-fiber content, spray rate, unit weight, product physical properties, anchor pull-off and shear strength, and curing period and conditions.
3. Prepare test specimens and test according to ASTM C 1228-96(2009), PCI MNL 128, and PCI MNL 130 procedures.
4. Test GFRC inserts and anchors according to ASTM C 1230-96(2009) to validate design values.
   a. Produce test boards at a rate of no fewer than one per work shift per operator for each spray machine and for each mix design. For each test board, determine glass-fiber content according to ASTM C 1229-94(2009) and flexural yield and ultimate strength according to ASTM C 947-03(2009).

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine structure and conditions for compliance with requirements for installation tolerances, bearing surfaces, and other conditions affecting performance of the Work. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 ERECTION

A. Install clips, hangers, and other accessories required for connecting GFRC panels to supporting members and backup materials.

B. Lift GFRC panels and install without damage

C. Install GFRC panels level, plumb, square, and in alignment. Provide temporary supports and bracing as required to maintain position, stability, and alignment of panels until permanent connections are completed.

1. Maintain horizontal and vertical joint alignment and uniform joint width.
2. Remove projecting hoisting devices.

D. Connect GFRC panels in position by bolting or welding, or both, as indicated on Shop Drawings. Remove temporary shims, wedges, and spacers as soon as possible after connecting is completed.

E. Welding: Comply with applicable AWS D1.1 and AWS D1.3 requirements for welding, appearance, quality of welds, and methods used in correcting welding work. Protect GFRC panels from damage by field welding or cutting operations, and provide noncombustible shields as required.

F. At bolted connections, use lock washers or other acceptable means to prevent loosening of nuts.

3.3 ERECTION TOLERANCES

A. Erect GFRC panels to comply with the following noncumulative tolerances:

1. Plan Location from Building Grid Datum: Plus or minus 1/2 inch.
2. Top Elevation from Nominal Top Elevation: As follows:
   a. Exposed Individual Panel: Plus or minus 1/4 inch.
   b. Nonexposed Individual Panel: Plus or minus 1/2 inch.
   c. Exposed Panel Relative to Adjacent Panel: 1/4 inch.
   d. Nonexposed Panel Relative to Adjacent Panel: 1/2 inch.
3. Support Elevation from Nominal Elevation: As follows:
   a. Maximum Low: 1/2 inch.
   b. Maximum High: 1/4 inch.
4. Maximum Plumb Variation over the Lesser of Height of Structure or 100 Feet: 1 inch.
5. Plumb in Any 10 Feet of Element Height: 1/4 inch.
6. Maximum Jog in Alignment of Matching Edges: 1/4 inch.
7. Maximum Jog in Alignment of Matching Faces: 1/4 inch.
8. Face Width of Joint: As follows (governs over joint taper):
   a. Panel Dimension 20 Feet or Less: Plus or minus 1/4 inch.
   b. Panel Dimension More Than 20 Feet: Plus or minus 3/8 inch.
9. Maximum Joint Taper: 3/8 inch.
10. Joint Taper in 10 Feet: 1/4 inch.
11. Differential Bowing, as Erected, between Adjacent Members of Same Design: 1/4 inch.

3.4 REPAIRS

A. Repairs are permitted provided structural adequacy of GFRC panel and appearance are not impaired, as approved by Architect.

B. Mix patching materials and repair GFRC so cured patches blend with color, texture, and uniformity

of adjacent exposed surfaces.

C. Prepare and repair accessible damaged galvanized coatings with galvanizing repair paint according to ASTM A 780-09.

D. Wire brush and clean accessible weld areas on prime-painted components and paint with same type of shop primer.

E. Remove and replace damaged GFRC panels when repairs do not comply with requirements.

3.5 CLEANING AND PROTECTION

A. Perform cleaning procedures, if necessary, according to GFRC manufacturer's written instructions. Clean soiled GFRC surfaces with detergent and water, using soft fiber brushes and sponges, and rinse with clean water. Prevent damage to GFRC surfaces and staining of adjacent materials.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Concrete masonry units.
2. Brick unit masonry.
3. Mortar and grout.
4. Reinforcement, anchorages, and accessories.
5. Through-wall flashing.
6. Masonry fill foam insulation.

B. Work Installed But not Furnished under this Section: Support plates and angles with anchor studs, sleeve anchors, expansion bolts, adhesive anchors, and anchor bolts which are embedded in masonry for supporting structural members.

C. Related Sections:
1. Section 01400 – Quality Control. Procedures for inspection, testing, and documentation by Testing Agency.
2. Section 03450 - Plant Precast Architectural Concrete: Precast sill units and wall caps.
3. Section 05500 - Metal Fabrications: Loose steel lintels and other metal components embedded in masonry.
4. Section 07180 - Water Repellents: Water repellent coating applied to exterior integrally colored concrete masonry surfaces.
5. Section 07901 - Joint Sealants: Rod and sealant at control joints.

1.2 REFERENCES

A. The publications listed below form a part of this specification to the extent referenced. Publications are referenced within the text by the basic designation only.

B. American Concrete Institute/American Society of Civil Engineers/The Masonry Society (ACI/ASCE/TMS) (Also known as Masonry Standards Joint Committee - MSJC standards):
1. ACI 530/ASCE 5/TMS 402 - Building Code Requirements for Masonry Structures.
2. ACI 530.1/ASCE6/TMS 602 - Specifications for Masonry Structures.

C. ASTM International (ASTM):
1. ASTM C 90 - Hollow Load-Bearing Concrete Masonry Units.
2. ASTM C 94 - Ready-Mixed Concrete.
3. ASTM C 129 - Non-Load-Bearing Concrete Masonry Units.
4. ASTM C 140 - Methods For Sampling And Testing Concrete Masonry Units And Related Units.
5. ASTM C 143 - Slump of Hydraulic Cement Concrete.
6. ASTM C 144 - Aggregate for Masonry Mortar.
7. ASTM C 150 - Portland Cement.
8. ASTM C 207 - Hydrated Lime for Masonry Purposes.
9. ASTM C 216 - Facing Brick (Solid Masonry Units Made from Clay or Shale.
10. ASTM C 270 - Mortar for Unit Masonry.
11. ASTM C 476 - Grout for Masonry.
12. ASTM C 549 - Perlite Loose Fill Insulation.
13. ASTM C 1329 - Mortar Cement.

D. Mason Contractors Association of America (MCAA):
   1. Standard Practice for Bracing Masonry Walls Under Construction

1.3 PERFORMANCE REQUIREMENTS

A. Provide unit masonry and grout that develops compressive strengths (f'm) at 28 days as indicated on Drawings.

1.4 SUBMITTALS

A. Section 01330 - Submittals: Submittal Procedures.

B. Shop Drawings: Do not use reproductions of Contract Documents as shop drawings. Prepare shop drawings in accordance with ACI 315.
   1. Reinforcement:
      a. Include masonry notes on shop drawings that relate to proper placing of reinforcing and submit shop drawings for use in the field.
      b. Reinforcing shown shall include but not limited to vertical and horizontal wall reinforcement, dowels, bond beam reinforcement, embedded steel items and anchor bolts.
   2. Placement Drawings:
      a. Shop drawings shall include sides, front and rear elevations of building showing masonry walls full height and length; reinforcing size, quantity, spacing, location, length, and grade of steel; and control joint locations.

C. Product Data - Mortar and Grout.
   1. Mix Design. Submit Masonry Grout Mix Design for each type of grout, and mix design for mortar, including description of type and proportions of ingredients:
      a. Include test reports, in accordance with ASTM C 780 for mortar test specified in Part 3.
      b. Include test reports, in accordance with ASTM C 1019 for grout mixes required complying with compressive strength requirement.
   2. Proportion method used.
   3. Required environmental conditions.
   4. Assurance that mix is free of admixtures.

D. 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 in accordance with Tables 1 and 2 in ACI 530.1/ASCE6/TMS 602. Submit Shop Drawings and Product Data within 5 working days of Contract date.

E. Testing and Inspection Reports: Submit reports in accordance with Section 01400.

F. Samples:
   1. Submit two full size face samples (soaps) of each type of integral colored CMU specified, indicating color range.
   2. Obtain Architect's approval prior to manufacture of CMU.

1.5 QUALITY ASSURANCE

A. Construct masonry in accordance with ACI 530/ASCE 5/TMS 402 and ACI 530.1/ASCE6/TMS 602.

B. Regulatory Requirements: Special inspection and testing will be provided in accordance with the Building Code and as noted on the Drawings and will be performed under provisions of Section 01400.

C. Mock-up: Construct a masonry wall panel mockup to represent the exterior masonry wall.
   1. Locate, construct, clean, inspect, and remove in accordance with notes indicated on the Drawings.
   2. When accepted, mock-up will be used as standard of quality for masonry Work.
   3. Mock-up may not remain as part of the Work.

D. Preconstruction Testing of Grout:
   1. Preconstruction testing shall be performed by the Contractor.
   2. Determine and certify that proportions of ingredients for mix design will provide the specified compressive strength for each type of grout.
   3. Test mix design prior to beginning construction of CMU walls.

E. Source Limitations:
   1. Masonry Units: Obtain exposed masonry units of a uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, through one source from a single manufacturer for each product required.
   2. Mortar Materials: Obtain mortar ingredients of uniform quality, including color for exposed masonry, from single manufacturer for each cementitious component and from one source or producer for each aggregate.

F. Fire-Resistance Ratings: Where indicated, provide materials and construction identical to those of assemblies with fire-resistance ratings determined per ASTM E 119 by a testing and inspecting agency, by equivalent concrete masonry thickness, or by other means, as acceptable to authorities having jurisdiction.

1.6 DELIVERY, STORAGE AND HANDLING

A. Store sand for mortar on plastic sheeting to prevent contamination by extraneous chemicals in earth beneath.

1.7 PROJECT CONDITIONS

A. Environmental Requirements (Cold Weather): Follow cold weather procedures of ACI 530.1/ASCE6/TMS 602. Include the following construction requirements for cold weather procedures.
   1. When Air Temperature is above 40 degrees F:
      a. Heating of Materials: Follow normal masonry procedures.
      b. Protection: Cover walls with plastic or canvas at end of workday to prevent water entering masonry.
   2. When Air Temperature is below 40 degrees F but over 32 degrees F:
      a. Heating of Materials: Heat mixing water. Maintain mortar temperatures between 40 and 120 degrees F until placed.
      b. Protection: Cover walls and materials to prevent wetting and freezing. Cover material: plastic or canvas.
   3. When Air Temperature is below 32 degrees F but over 20 degrees F:
      a. Heating of Materials: In addition to above heating requirements, heat sand. Thaw frozen sand and frozen wet masonry units. Maintain masonry above 32 degrees F, by using auxiliary heat or insulated blankets for 16 hours after laying masonry units.
      b. Protection: With wind velocities over 15 mph, provide windbreaks during the work day and cover walls and materials at the end of the workday to prevent wetting and freezing.
   4. When Air Temperature is below 20 degrees F:
      a. Heating of Materials: In addition to above heating requirements, dry masonry units by heating to 40 degrees F.

b. Protection: Provide enclosures and supply sufficient heat to maintain masonry enclosure above 32 degrees F for 24 hours after laying masonry units.

B. Environmental Requirements:
1. Cold Weather Requirements: Comply with cold weather construction requirements contained in ACI 530.1/ASCE6/TMS 602. When the ambient air temperature is below 40 degrees F, heat mixing water to maintain mortar temperature between 40 degrees F and 120 degrees F until placed. When the ambient air temperature is below 32 degrees F, heat the sand and water to maintain this mortar temperature.
a. Do not use frozen materials or materials mixed or coated with ice or frost.
b. Do not build on frozen substrates.
c. Remove and replace unit masonry damaged by frost or by freezing conditions.
2. Hot Weather Requirements: Comply with hot-weather construction requirements contained in ACI 530.1/ASCE6/TMS 602. When the ambient air temperature exceeds 100 degrees F, or 90 degrees F with a wind velocity greater than 8 mph, execute the following:
a. Store masonry units out of direct sunlight.
b. Do not spread mortar beds more than 4 feet ahead of masonry.
c. Set masonry units within one minute of spreading mortar.

PART 2 - PRODUCTS

2.1 CONCRETE MASONRY UNITS

A. Unit Design: Modular two core units sized as indicated or scheduled. Provide special shapes necessary for bond beams, control and expansion joints, lintels, and special conditions.
1. Provide units as required for indicated construction including sill units and solid cap units.
2. Provide units with exposed faces which are uniform in appearance.
3. Units to receive paint or coatings shall contain a minimum of 12% fly ash or Ground Granulated Blast Furnace Slag (GGBFS) as a replacement of the total cementitious content. Use of fly ash or GGBFS in painted or coated units is mandatory.

B. Hollow Load Bearing Units: ASTM C 90.
1. Smooth CMU: Light weight or normal weight above finished floor; normal weight only below finished floor.
2. Split Face CMU: Light weight or normal weight above finished floor; normal weight only below finished floor.

C. Solid Load-bearing Units: ASTM C 90.
1. Smooth CMU: Light weight or normal weight above finished floor; normal weight only below finished floor.
2. Split Face CMU: Light weight or normal weight above finished floor; normal weight only below finished floor.

D. Non-load Bearing Units: ASTM C 129.

E. Light Weight Aggregate: ASTM C 331, free of materials that will cause rusting, staining, or popouts.

F. Fire Resistance Classification: In accordance with UL, FM, WH, or SWRI listing and fire resistance rating required for CMU wall and partition assemblies and components. Provide units of minimum equivalent thickness specified for the fire rating and for corresponding aggregate type.

G. Integrally Colored CMU:

1. Conform to CMU requirements specified above.
2. Integral mineral pigment coloring.
3. Integral Water Repellent: Provide exposed units made with integral water repellent specified in this Section. Units made with integral water repellent, when tested as a wall assembly made with mortar containing integral water-repellent mortar additive according to ASTM E 514, with test period extended to 24 hours, show no visible water or leaks on the back of test specimen.
4. Fly ash and slag are prohibited in integrally colored CMU.
5. Smooth or split faced as shown on the Drawings.
6. Color to be selected by Architect or Owners Representative from a full range of manufacturer's standard colors.

H. Architectural Masonry: Hollow core half-height concrete block units manufactured to resemble appearance of face brick with the following characteristics:
1. Normal weight CMU conforming to requirements of hollow load bearing units specified above.
2. Integral mineral pigment coloring.
3. Integral water repellant for increased water resistance.
4. Fly ash and slag are prohibited in architectural masonry.
5. Manufacturers:
   a. Quik-Brik by Oldcastle. Contact: Oldcastle, Jim Cooper (877) 506-2745, jim.cooper@oldcastleapg.com
   b. Half-height CMU by Dolese. Contact: Billy Crooke (405) 613-5502.
   c. Wall Brick by Cemex, Asheville, NC. Contact: Michael Pike (800) 786-5620.
   d. Spec-Brik by Concrete Products Group, Denver, CO. Contact Bill Dawson at (800) 789-0872, info@concreteproductsgroup.com.
6. Color to be selected by Architect or Owners Representative from a full range of manufacturer's standard colors.

I. Ground Faced CMU:
1. Conform to ASTM C-90 requirements with minimum density of 110 pounds per cubic foot.
2. Integral mineral pigment coloring.
3. Integral Water Repellent: Provide exposed units made with integral water repellent specified in this Section. Units made with integral water repellent, when tested as a wall assembly made with mortar containing integral water-repellent mortar additive according to ASTM E 514, with test period extended to 24 hours, show no visible water or leaks on the back of test specimen.
4. Fly ash and slag are prohibited in integrally colored CMU.
5. DryBlock (or approved equivalent): provide manufacturer's recommended amount.
6. Manufacturers: Provide one of the following or approved equal
   a. Westbrook Concrete Block Company
   b. Trenwyth by Echelon Masonry
   c. County Materials Corporation
   d. Gemstone by York Building Products Contact: North Georgia Brick, Jamie Hustey (678-455-2251, jhustey@ngabrick.com
7. Color to be selected by Architect or Owners Representative from a full range of manufacturer's standard colors.

2.2 BRICK

A. General: Provide shapes indicated and as follows for each form of brick required.

1. Provide units without cores or frogs and with exposed surfaces finished for ends of sills and caps and for similar applications that would otherwise expose unfinished brick surfaces.

B. Provide special shapes for applications requiring brick of size, form, color, and texture on exposed surfaces that cannot be produced by sawing.

1. Provide special shapes for applications where stretcher units cannot accommodate special conditions, including those at corners, movement joints, bond beams, sashes, and lintels.
2. Provide special shapes for applications where shapes produced by sawing would result in sawed surfaces being exposed to view.

C. Manufacturers: Provide brick by the following manufacturer or approved equal, meeting the requirements indicated below.

1. Meridian Brick. Contact: North Georgia Brick, Jamie Hustey (678) 455-2251, jhustey@ngabrick.com

D. Face Brick: ASTM C 216 and as follows:

1. Grade and Unit Compressive Strength: Provide units with grade and minimum average net area compressive strength indicated below:
   a. Grade: SW.
   b. 3000 psi (20.7 MPa).

2. Surface Coloring: Brick with surface coloring, other than flashed or sand-finished brick, shall withstand 50 cycles of freezing and thawing per ASTM C 67 with no observable difference in the applied finish when viewed from 10 feet (3 m).
3. Type: FBS
4. Size: Bricks manufactured to the following actual dimensions within tolerances specified in ASTM C 216-95a:
   a. Modular: 3-1/2 to 3-5/8 inches (89 to 92 mm) thick by 2-1/4 inches (57 mm) high by 7-1/2 to 7-5/8 inches (190 to 194 mm) long.
5. Color and Texture: To be selected by Architect or Owner's rep from a full range of manufacturer's standard colors.

2.3 MORTAR AND GROUT MATERIALS

A. Portland Cement: ASTM C 150, normal-Type I or Type II; gray color. Fly ash, slag, and pozzolans not permitted as substitutes for Portland cement except as otherwise specifically allowed.

B. Mortar Cement: ASTM C 1329, Type S

C. Fly Ash: ASTM C 618, Type C or F maximum 4 percent loss in ignition shall be used as a replacement for Portland cement in grout. Fly ash shall be a minimum of 25 percent and a maximum of 30 percent of the total cementitious content. Use of fly ash in the grout mix is mandatory.

D. Fly ash, slag and pozzolans not permitted as substitutes for Portland cement in mortar.

E. Masonry Cement: Not allowed.

F. Mortar Aggregate: ASTM C 144, standard masonry type; clean, dry, protected against dampness, freezing, and foreign matter.

G. Mortar Pigments: Natural and synthetic iron oxides and chromium oxides, compounded for use in mortar mixes. Use pigments with a record of satisfactory performance in masonry mortar.

H. Grout Aggregate: ASTM C 404; use of blast furnace slag is not permitted. Maximum coarse aggregate size, 3/8 inch.

I. Calcium chloride: Not permitted in mortar or grout. Chemicals containing Thyocyanates, Calcium Chloride or more than 0.1 percent chloride ions shall not be used.

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

K. Water: Potable.

L. Admixtures: Not permitted in mortar or grout except as otherwise specifically required herein.

M. Water-Repellent Admixture: Liquid water-repellent mortar admixture containing integral water repellent by same manufacturer as used with integral colored CMU as specified above.

2.4 MIXES - MORTAR

A. Mortar: Type "S", in accordance with the Proportion Specification of ASTM C 270.
1. Mixing of components on-site is acceptable.
2. Mixing on-site water and packaged dry blended mix for mortar (ASTM C 387 or C1329), that contains no masonry cement, is acceptable.
3. Use of ready mix mortar (ASTM C 1142) is prohibited.
4. Do not add admixtures of any kind to mortar mix except as otherwise specifically required herein.

B. Pointing Mortar: Duplicate original mortar proportions. Add aluminum tristearate, calcium stearate, or ammonium stearate equal to 2% of Portland cement weight.

C. Mortar Color (CMU): Match color of integrally colored or unpainted natural color CMU. Color of mortar at painted CMU is optional.

D. Mortar Color (Brick): To be selected by Architect from a full range of manufacturers standard colors.

2.5 MIXING – MORTAR

A. Thoroughly mix mortar ingredients in accordance with ASTM C 270, in quantities needed for immediate use.
1. Maintain sand uniformly damp immediately before the mixing process.
2. Provide uniformity of mix and coloration.
3. Do not use anti-freeze compounds.
4. If water is lost by evaporation, retemper only within 2 hours of mixing. Do not retemper mortar more than 2 hours after mixing.

2.6 MIXES - GROUT FILL

A. Grout fill for concrete masonry unit bond beams, lintels, and reinforced cells with reinforcing bars and embedded plates: Conform to ASTM C 476.
1. Compressive Strength: 3000 psi minimum at 28 days, as determined in accordance with the provisions of ASTM C 1019.
2. Slump: 8 inches, minimum; 11 inches, maximum, taken in accordance with ASTM C 143.
3. Use coarse grout when grout space is equal to or greater than 4 inches in both directions.
4. Use fine grout when grout space is smaller than 4 inches in either direction.
5. Air entrainment shall not be used.
6. Do not add admixtures of any kind to grout.

2.7 MIXING – GROUT

A. Batch and mix grout in accordance with ASTM C 94 or ASTM C 476 for site batched and mixed grout. Do not use anti-freeze compounds to lower the freezing point of grout.

2.8 REINFORCEMENT AND ANCHORAGES

A. Horizontal Joint Reinforcement: Ladder design, minimum 9 gage welded steel wire, hot dipped galvanized to 1.5 oz, ASTM A 153, Class B2. Width 1-1/2 to 2 inches less than wall thickness.

B. Deformed Bars: ASTM A 615, Grade 60. Shop fabricate reinforcement which is shown bent or hooked. Field bending not allowed.

C. Anchor bolts and threaded rods as shown embedded in masonry on structural drawings: ASTM A 307.

D. Adhesive for embedding threaded rods: Cartridge type two-component adhesive.
1. HIT HY-150 by Hilti Corp.
2. Epcon System, Ceramic 6 by ITW Ramset/Red Head
3. Epoxy-Tie SET by Simson Strong Tie Co. Inc.
4. Substitutions: Not permitted.

E. Bar Positioners for Vertical Wall Bars: Minimum 9 gage, galvanized wire.
1. AA Wire Products Co.; Dallas, TX; (214) 637-1511.
2. Dur-O-Wal, Inc.; Arlington Heights, IL; (708) 577-6400.
3. Wire-Bond; Charlotte, NC; (800) 441-8359.

2.9 TIE AND ANCHORS

A. Adjustable Wall Ties (Pintles & Eyes): Minimum 9 gage, galvanized

B. Spacing: Maximum 16 inches on center horizontally or as otherwise indicated on Drawings

2.10 ACCESSORIES

A. Joint Filler: Closed cell foam, oversized 50 percent; self-expanding.

B. Preformed Control Joint Filler:
1. Regular Joint: 2-5/8 inches by 1-1/2 inches; rubber.
   a. Rapid Control Joint D/A 2001, by Dur-O-Wal, Inc., Aurora, IL (800) 323-0090
   b. Control Joint No. 9101, by Southern Construction Products, Inc.; Birmingham, AL; (800) 821-9296.
   c. Masonry Control Joint No. 571; by Greenstreak; St. Louis, MO; (800) 325-9504.
2. Tee Joint: 2-5/8 inches by 1 inch; rubber.
   a. Rapid Control Joint D/A 2025, by Dur-O-Wal, Inc., Aurora, IL, (800) 323-0090.
   b. Control Joint No. 9107, by Southern Construction Products, Inc.; Birmingham, AL; (800) 821-9296.
   c. Masonry Control Joint No. 572; by Greenstreak; St. Louis, MO; (800) 325-9504.

C. Preformed Expansion Joint Filler: One Inch Expansion Joint: Secondary compression seal.
1. Backerseal (Grayflex) expanding precompressed foam by Emseal Joint Systems, Ltd., Westborough, MA (800) 526-8365.
2. IllbruckWillseal 600 polyurethyene foam joint sealing tape by Willseal USA, Pelham, NH (800) 438-0684.

D. Through-Wall Flashing: Sheet copper, total metal weight 5 ounces per sq ft, laminated with protective coating on both sides. Provide one of the following:
   1. Copper Fabric or Copper Sealtight 2000, by Advanced Building Products Inc., Springvale, ME (800) 252-2306.
   2. Copper Fabric, by Sandell Manufacturing Co., Schenectady, NY (800) 283-3888.
   3. York Copper Fabric Flashing or Multi Flash 500, by York Manufacturing, Inc., Sanford, ME (207) 324-1300.

E. Adhesive: As recommended by flashing material manufacturer.

F. Weeps: Galvanized steel or plastic tubes.

G. Grout Barrier: Provide one of the following:
   1. DA1015-DA1018 Dur-O-Stop, by Dur-O-Wal.
   2. MGS Grout Screen, by Hohmann & Barnard, Inc.

2.11 MASONRY FILL INSULATION

A. Non Formaldehyde Forming Foamed In Place Insulation: Subject to compliance with project requirements and local jurisdictional restrictions, manufacturers offering Foam In-Place Insulation tested and found compatible and non-detrimental within the indicated Underwriters Laboratory fire resistance assemblies which may be incorporated into the Work include the following:
   1. Core-Fill 500; by Tailored Chemical Products, Inc.; Hickory, NC; (800) 627-1687.
   2. CoreFoam Insulation, by CoreFoam, Inc., Knoxville, TN; (800) 656-3626
   3. R-501 Polymaster Plastic Foam Insulation; by PolyMaster, Inc.; Knoxville, TN; (800) 580-3626.
   4. Rapco Blue; by JESCO, Inc.; Florence, SC; (843) 665-5350.
   5. Thermco Foam; by Thermal Corp. of America; Mt. Pleasant, IA; (319) 385-1535.
   6. Tripolymer Foam Insulation; by C.P. Chemical Co., Inc.; White Plains, NY.; (914) 428-2517.
   7. Substitutions: None accepted.

B. Expanded polystyrene bead type loose or blown fill insulation shall not be used.

PART 3 - EXECUTION

3.1 PREPARATION

A. Verify items provided by other sections of work are properly sized and located.

B. Establish lines, levels, and coursing. Protect from disturbance. Use non-corrosive materials in contact with masonry work.

C. Provide temporary bracing for walls, lintels, and other masonry work during erection. Maintain in place until roof and other structural elements are complete and provide permanent bracing.

D. Provide temporary bracing for walls, lintels, and other masonry work during erection.
   1. Design bracing in accordance with MCAA Standard Practice for Bracing Masonry Walls Under Construction.
   2. Design bracing under supervision of an independent Professional Engineer hired by the contractor and licensed in the state in which the project is located.
   3. Maintain in place until roof and other structural elements are complete and provide permanent bracing.

E. Wetting of Brick: Wet brick before laying if initial rate of absorption exceeds 30 g/30 sq. in. per minute when tested in accordance with ASTM C 67. Allow units to absorb water until damp but not wet at time of laying.

3.2 COURSING

A. Place masonry to lines and levels indicated.

B. Maintain masonry courses to uniform width. Make vertical and horizontal joints equal and of uniform thickness.

C. Lay concrete masonry units in running bond unless otherwise noted. Course one block unit and one mortar joint to equal 8 inches (4 inches for half high units).

D. Tool head and bed joints concave when mortar is thumbprint hard regardless if below grade or above ceiling height. Use tool with large enough radius that joint is not raked free of mortar.

E. Lay brick in running bond

3.3 PLACING AND BONDING

A. Lay solid concrete masonry units with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not slush head joints. Remove excess mortar.

B. For hollow concrete masonry units, fill head and bed joints solidly with mortar for a distance in from the face of the unit not less than the thickness of the shell. Bed webs in mortar in starting course on footings and foundation walls and in courses of piers, columns and pilasters, and where adjacent to cells or cavities to be reinforced or filled with concrete or grout. For starting courses on footings, spread out full mortar bed, including areas under cells.

C. Fully bond intersections, and external and internal corners.

D. Do not shift or tap masonry units after mortar has taken initial set. Where adjustment must be made, remove mortar and replace.

E. Perform jobsite cutting with proper tools to provide straight unchipped edges. Take care to prevent breaking masonry unit corners or edges.
   1. Where required, match finish masonry work to adjacent surfaces.
   2. For fire-rated walls, construct walls to finish against bottom of roof or floor deck and fill voids with firestopping.
   3. For other than fire-rated walls, cut units to match the slope of the roof deck and finish construction to within 2 inches of and parallel to roof deck.

F. Isolate masonry partitions from vertical structural framing members with a control joint.

G. Fire Rated Construction: Install masonry to comply with designated UL assembly without diminishing structural requirements.

3.4 TOLERANCES

A. Construct masonry within the following tolerances:
   1. Alignment of Pilasters: Maximum 1/4 inch from true line.
   2. Variation from Plane of Wall: 1/4 inch in 10 feet; 3/8 inch in 20 feet; 1/2 inch maximum.

3. Variation from Plumb: 1/4 inch per story non-cumulative.
4. Variation from Level Coursing: 1/8 inch in 3 feet; 1/4 inch in 10 feet; 1/2 inch maximum.
5. Variation of Joint Thickness: 1/8 inch in 3 feet.
6. Variation from Unit to Adjacent Unit: 1/32 inch maximum.

B. Tolerances for the placement of reinforcing steel in walls and flexural elements:
1. ± 1/2 inch when the distance from the centerline of the steel to the opposite face of the masonry, "d", is equal to 8 inches or less.
2. ± 1 inch for "d" equal to 24 inches or less but larger than 8 inches.
3. ± 1-1/4 inch for "d" greater than 24 inches.

3.5 REINFORCEMENT AND ANCHORAGES

A. Install horizontal joint reinforcement 16 inches on center, or where otherwise indicated on Drawings. Place joint reinforcement continuous in first and second joint below top of walls. Lap joint reinforcement ends minimum 6 inches. Do not extend joint reinforcement through control joints.
1. Coordinate installation of veneer anchors

B. Set vertical reinforcing bars supported and secured against displacement by means of bar positioners prior to placing grout. Set and support other bars, anchor bolts, and embedded items and tie to prevent displacement prior to placing grout.

C. Grout cells full that contain vertical reinforcing. Use low lift grout method of construction conforming to requirements of ACI 530/ASCE 5/TMS.

D. Place grout barrier below reinforced bond beams as required to prevent grout falling through cells while maintaining positive bond in mortar joint.

E. Verify that anchorages embedded in masonry are properly placed.
1. Proper placement of embed anchors shall be full depth penetration of scheduled anchorage without contact of embed stud with interior surface of exterior shell face.

F. After reinforcing of masonry is securely tied in place, plug cleanout holes with masonry units. Brace against wet grout pressure.

3.6 MASONRY FILL INSULATION

A. Confirm that selected foam insulation material is compatible and non-detrimental to referenced fire resistance assemblies before use.

B. Install insulation in masonry unit cores of exterior walls.

C. Non Formaldehyde Forming Foamed-In-Place Insulation:
1. Installer shall be certified and/or approved by manufacturer of insulation. Install foam insulation in strict accordance with manufacturer's published instructions.
2. Pump foam insulation bored into mortar joints around entire wall area 3 feet from floor level. Repeat at height no greater than ten feet until completion of wall area.
3. Plug holes with mortar after completion.

3.7 LINTELS

A. Install loose steel lintels as scheduled.

B. Install reinforced unit masonry lintels over openings where steel lintels are not scheduled. Construct lintels using grout fill and reinforcing. Maintain minimum 8 inch bearing on each side of opening, unless noted otherwise on Drawings.

C. Use reinforcing bars of one piece lengths only.

D. Place and consolidate grout fill without disturbing reinforcing. Allow lintels to reach strength before removing temporary supports.

E. For soap units covering steel lintels, provide 9 gage Z-ties at each vertical joint. Weld Z-ties to web of steel lintel.

3.8 CONTROL JOINTS

A. Do not continue bond beam reinforcing (except at floor and roof levels and top of walls) or joint reinforcing across control joints unless otherwise shown on the Drawings.

B. Install preformed control joint filler at locations indicated on Drawings. Use proper size material to create sealant joint space. For backer rod and sealant see Section 07900.

3.9 BUILT-IN WORK

A. As work progresses, build in metal door frames, fabricated metal frames, window frames, anchor bolts, diaphragm anchors, embedded plates, and other items included in the work supplied by other Sections.
1. Masonry Reglet: Install reglet level and parallel to building lines. Set reglet as indicated to coordinate with sloped roof surface.

B. Install items plumb and level.

C. Bed anchors of metal door and glazed frames in mortar joints. Fill frame voids solid with grout or mortar. Fill masonry cores with grout minimum 12 inches from framed openings.

D. Do not build in organic materials subject to deterioration.

3.10 CUTTING AND FITTING

A. Cut and fit for bearing plates, chases, pipes, conduit, sleeves, and grounds. Coordinate with other Sections of work to provide correct size, shape, and location.

B. Obtain approval prior to cutting or fitting any area not indicated or where appearance or strength of masonry work may be impaired.

3.11 CLEANING

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

B. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:
1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
2. Protect non-masonry surfaces from contact with cleaner by covering them with liquid strippable masking agent, polyethylene film, or waterproof masking tape.

3. Clean non-colored CMU masonry with a proprietary acidic cleaner applied according to manufacturer's written instructions.
4. Clean integral colored CMU with a non-acidic proprietary cleaner applied according to manufacturer's written instructions.
5. Clean brick with a non-acidic proprietary cleaner applied to manufacturers written instructions.
6. Cleaned surfaces shall appear as represented by mockup wall panel.

C. Remove excess mortar and smears. Replace defective mortar. Match adjacent work.

D. Clean soiled surfaces with a non-acidic solution which will not harm masonry or adjacent materials. Consult masonry manufacturer for acceptable cleaners.

E. Use non-metallic tools in cleaning operations.

3.12 PROTECTION

A. Maintain protective boards at exposed external corners which may be damaged by construction activities.

B. Provide protection without damaging completed work.

C. Protect the base of walls from rain-splashed mud and mortar droppings.

D. At day's end, cover unfinished walls to prevent moisture infiltration. Weight cover down to prevent blow-off and maintain protection for fresh masonry work. Extend cover from top of wall a minimum of 2 feet down the wall on each side.

3.13 FIELD QUALITY CONTROL

A. Engage the services of an independent testing agency to perform the following testing for field quality control.

B. Testing Frequency: Tests and Evaluations listed in this Article will be performed during construction for each 5000 sq. ft. (460 sq. m) of wall area or portion thereof.

C. Mortar properties will be tested per property specification of ASTM C 270.

D. Mortar composition and properties will be evaluated per ASTM C 780.

E. Grout will be sampled and tested for compressive strength per ASTM C 1019.

F. Evaluation of Quality-Control Tests: In the absence of other indications of noncompliance with requirements, masonry will be considered satisfactory if results from construction quality-control tests comply with minimum requirements indicated.

3.14 MASONRY WASTE DISPOSAL

A. Recycling: Undamaged, excess masonry materials are Contractor's property and shall be removed from the Project site for his use.

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

END OF SECTION

PART 1 GENERAL

1.1 DESCRIPTION

A. Furnish all labor, materials, equipment and incidentals required to construct all masonry work as shown on the Drawings and specified herein.

B. The work under this Section includes but is not necessarily limited to the following:

1. Concrete masonry units.

2. Reinforced CMU lintels.

3. Masonry reinforcing, ties and anchors.

PART 2 PRODUCTS

2.1 MATERIALS - MASONRY

A. Concrete Masonry Units

1. Concrete masonry units (CMU) shall conform to ASTM C90 and ACI 530.1, and be Class "A" hollow, load bearing units. Concrete masonry units shall be 8”x8”x12” and 8”x12”x16”. All exposed vertical corners shall be bull nosed.

2. CMU shall be free from substances that will cause staining or pop-outs, and shall be fine, even textured wet steam cured for at least 18 hours and then air cured in covered storage for not less than 28 days before delivery. Units shall have a maximum linear drying shrinkage of 0.25 percent (ASTM C246) and have a moisture content at time of delivery not exceeding 30 percent of total absorption.

3. CMU noted as fire-rated on the Drawings shall conform to Underwriters Laboratories, Inc., Standard for Concrete Masonry Units UL 618, and shall have one (1) and two (2) hour fire resistant rating.

4. Units shall be obtained from one manufacturer to insure even color and texture.

5. Provide special units required by the Drawings, including solid, corner, pilaster, lintels, and jamb units.

2.2 REINFORCING, TIES, ANCHORS AND MISCELLANEOUS

A. Single wythe reinforcement shall be truss type, fabricated with single pair of galvanized 9 gauge side rods and continuous 9 gauge diagonal cross-rods spaced not more than 16 in o.c. vertical.

B. The Contractor shall provide and install miscellaneous anchors and attachment members, required both for the anchorage of his own work and that of other trades requiring attachment to masonry, which are not specifically provided under separate sections.

C. Cleaning compound shall be mild, non-caustic detergent solution such as 801 Super Real Clean by

Superior Manufacturing Company, or 600 Sureclean by Process Solvent Company, Inc. or 202 New Masonry Detergent by Deadrich Technologies.

2.3 MORTAR MATERIALS

A. Portland cement shall conform to ASTM C150 Type I. Masonry cements shall NOT be used unless specifically approved for colored mortar.

B. Lime for masonry mortar shall be hydrated, conforming to ASTM C207, Type S.

C. Sand shall be clean, durable particles, free from injurious amounts of organic matter. The sand shall conform to the limits of ASTM C144. Sand for grout shall conform to ASTM C144 or C33 as required. All Mason's sand to be shipped from one supplier all at once.

D. Water shall be free from injurious amounts of oils, acids, alkalis or organic matter, and shall be clean and fresh.

E. Mortar shall conform to ASTM C270, Type S, consisting of 1 part Portland cement, 1/2 part lime, 4-1/2 parts sand, or as otherwise approved by the Architect. Ingredients shall be accurately measured by volume in boxes specially constructed for the purpose by the Contractor. Measurement by shovel will not be allowed.

F. Grout for setting bearing plates, machinery, or any other equipment shall be mixed as recommended by the manufacturer to give the necessary consistency for placing and to give a minimum compressive strength of 3,000 lbs per square inch in three (3) days.

G. All other grout shall be 1 part Portland cement and 1 part sand.

H. Non-shrink grout shall utilize Embeco Aggregate as manufactured by the Masters Builders Company, Ferrolith by Sonneborn and be proportioned with sand in strict accordance with the manufacturer's instructions for the use intended.

I. Colored premixed mortar to be manufactured by Flamingo. All mason's sand for colored masonry to be from same supplier and delivered to site at one time.

2.4 REINFORCED CONCRETE MASONRY

A. All concrete masonry walls shall be designed in accordance with the specifications for the design and construction of load bearing concrete masonry by NCMA.

B. Materials:

1. Concrete masonry units: Shall conform to ASTM C90 with a required fm=2000 psi.

2. Mortar: Type S, minimum 28 day cure. Strength to be 1,800 psi, complying with ASTM C270 and ASTM 150. Mortar cure tests shall be submitted for approval prior to construction.

3. Grout: Shall be pearock grout conforming to ASTM C-476-71. Grout to be 2500 psi minimum at 28 days and slump shall not exceed 8 inches. All grout fill in masonry cells shall be field tested.

4. Reinforcing Bars: Shall be ASTM A-615 Grade 60.

PART 3 EXECUTION

3.1 MORTAR

A. Mortar shall be machine mixed in an approved type of mixer in which the quantity of water can be accurately and uniformly controlled. The mixing time shall not be less than 5 minutes, approximately 2 minutes of which shall be for mixing the dry materials and not less than 3 minutes for continuing the mixing after the water has been added.

B. Where the dry-mix method is employed, the materials for each batch shall be well turned over together until the even color of the mixed, dry materials indicates that the cementious material has been thoroughly distributed throughout the mass, after which the water shall be gradually added until a thoroughly mixed mortar of the required plasticity is obtained.

C. Mortar boxes shall be cleaned out at the end of each day's work, and all tools shall be kept clean. Mortar that has begun to set shall not be used.

3.2 MASONRY - INSTALLATION

A. No material which is frozen or covered with frost or snow shall be used in the construction, and no antifreeze salts or ingredients shall be mixed with the mortar. Masonry shall not be laid at temperatures below 40 degrees F, without the approval of the Architect, and all work shall be done in such a manner as to insure the proper and normal hardening of all mortar. All masonry work shall be so protected and heated that the temperature at the surface will not fall below 50 degrees F for a period of 72 hours after placing. Any completed work found to be affected by freezing shall be taken down and rebuilt by the Contractor at his expense.

B. All CMU shall be laid in a full bed of mortar, applied to shells only. Butter the vertical joint of unit already set in the wall and all contact faces of the unit to be set. Each unit shall be placed and shoved against the unit previously laid so as to produce a well compacted vertical mortar joint for the full shell thickness. Units shall set with all cells in a vertical position. The moisture content of the units when laid shall not exceed 35 percent of the total absorption as determined by laboratory test.

C. All masonry units shall be laid in stretcher (running) bond unless otherwise shown. Tool dense and neat.

D. Sizes shall be as specified and called for on the Drawings, and where "Soaps" and "Splits" are used, the space between these members and the backup material shall be slushed full of mortar.

E. Joints of all masonry shall be tooled in accordance with the following:

1. Wait until unit mortar is thumbprint hard before tooling joint.

2. The required personnel of the Contractor shall be kept on the job after hours, if necessary, to properly tool joints.

3. Both vertical and horizontal joints shall be maintained uniform in spacing.

4. Joints for CMU shall be 3/8 inch.

F. Install all frames required to be set in masonry, set masonry tightly against frames, build in all frame anchors, and fill frames with mortar.

G. All masonry slots, chases, or openings required for the proper installation of the work of other Sections shall be constructed as indicated on th e Drawings or in accordance with information furnished before the work is started at the points affected. No chase shall cut into any wall constructed of hollow units after it is built, except as directed and approved by the Architect.

H. Surfaces shall be brushed as work progresses and maintained as clean as it is practicable. Unfinished work shall be raked back where possible, and toothed only where absolutely necessary. Before leaving fresh or unfinished work, walls shall be fully covered and protected against rain and wind and before continuing work previously laid shall be swept clean. The tops of walls or other unfinished work shall be protected against all damage by frost or the elements by means of waterproof paper, tarpaulins, boards or other means approved by the Architect.

I. The Contractor shall build in all miscellaneous items to be set in masonry for which placement is not specifically provided under separate Divisions, including reglets, lintels, ties, electrical panel boxes, sleeves, vents grilles, anchors, grounds, and exterior electric conduits and fixtures, and shall cooperate with other trades whose work is to be coordinated with the work under this Section.

J. All anchorage, attachment, and bonding devices shall be set so as to prevent slippage and shall be completely covered with mortar or grout.

K. All ties and reinforcing for masonry shall be furnished and installed by the Contractor.

L. Bed and grout all steel, for equipment and machinery, and items coming in contact with masonry where grouting is required, including door bucks and frames set in masonry. The Contractor shall install all anchor bolts, base plates, and seats in masonry walls, and build in all items required for the completion of the building as they apply to masonry.

3.3 CLEANING

A. All holes in exposed masonry shall be pointed, and defective joints shall be cut out and re-pointed with mortar of same color as that of the original and adjoining work.

B. Exposed masonry shall be protected against staining by wall coverings, and excess mortar shall be wiped off the surface as the work progresses.

C. All masonry shall be cleaned with approved detergent solution in accordance with manufacturer's printed directions. No acid or metal scrapers shall be used on masonry.

D. Before applying any cleaning agent to the entire wall, it shall be applied to a sample wall area of approximately 20 square feet in a location approved by the Architect. No further cleaning work may proceed until the sample area has been approved by the Architect, after which time the same cleaning materials and method shall be used on the remaining wall area.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:

1. Stone countertops.
2. Stone side and backsplashes.

B. Related Sections:

1. Division 05 Section "Metal Fabrications" for steel countertop supports.

1.2 REFERENCES

A. ASTM C 119-04: Terminology Relating to Dimension Stone

B. ASTM C 170-90 (1999): Test Method for Compressive Strength of Dimension Stone

C. ASTM C 615-03: Specification for Granite Dimension Stone

D. ASTM C 880-98: Test Method for Flexural Strength of Dimensional Stone

1.3 SUBMITTALS

A. Product Data: For each granite stone, accessories, and other manufactured products.

1. Each stone type: Physical properties

B. Shop Drawings: Include plans, sections, details, and attachments to other work. Show fabrication and installation details for dimension stone cladding:

1. Include dimensions and profiles of stone units.
2. Show locations and details of joints.
3. Show locations and details of anchors and supports.

C. Stone Samples: (2) Sets for each stone required, exhibiting the full range of color characteristics expected; not less than 6 inches square.

1. Sealant Samples: For each type and color of joint sealant required.

D. Sealant Compatibility Test Report: Submit test report from sealant manufacturer, in accordance with Division 07 Section "Joint Sealants" stating that sealants will not stain stone.

E. Maintenance Data: Provide maintenance manuals for stone countertops. Include stone-care products recommended by stone source.

1.4 QUALITY ASSURANCE

A. Fabricator Qualifications: Skilled workers who custom-fabricate stone countertops similar to work of this Project.

B. Source Limitations for Stone: Obtain each variety of stone from a single quarry.

1. Obtain each variety of stone from a single quarry, whether specified in this Section or in another Section of the Specifications.
2. Make stone slabs available for Architect to examine for appearance characteristics.

a. Architect will select aesthetically acceptable slabs and will indicate aesthetically unacceptable portions of slabs.

C. Mockup: Build mockup to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Build mockup of typical countertop as shown on Drawings.
2. Approved mockup may become part of the completed Work.

1.5 PROJECT CONDITIONS

A. Field Measurements: Verify dimensions of construction to receive stone countertops by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 STONE SOURCE

A. Manufacturers: Provide products from one of the following manufacturers, or approved equivalent, subject to compliance with requirements.

1. MC Granite, 2143 Moon Station Drive, Kennesaw, GA 30144, Phone 770-833-8075

2. Legacy Granite Countertops, 5872 Atlanta Highway Alpharetta, GA 30004, Phone 678-867-0100 Email: lgcgranite@gmail.com

3. Granite Countertop Warehouse, 116 Bethea Rd Suite 308 and 310, Fayetteville GA 30214, Phone: (404) 592-5599 or (678) 391-9262

2.2 STONE MATERIAL

A. Granite: ASTM C 615.

B. Cut stone from one block or contiguous, matched blocks in which natural markings occur.

C. Color to be selected by Architect or Owner's representative from a full range of manufacturers standard color samples.

D. Granite characteristics:

1. Finish: Polished

2. Thickness: 1 1/2":

2.3 STONE ACCESSORIES

A. General: Use only adhesives formulated for stone and recommended by manufacturer for the application shown on Drawings.

B. Water-Cleanable Epoxy Adhesive: 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).

C. Water-Cleanable Epoxy Grout: ANSI A118.3, chemical-resistant, water-cleanable, tile-setting and -grouting epoxy, with a VOC content of 65 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

D. Stone Adhesive: 2-part epoxy or polyester adhesive, formulated specifically for bonding stone to stone, with an initial set time of not more than 2 hours at 70 deg F, and with a VOC content of 65 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

1. Color: Match stone.

E. Sealant for Countertops: Manufacturer's standard sealant of characteristics indicated below that comply with applicable requirements in Division 07 Section "Joint Sealants" and will not stain the stone it is applied to.

1. Single-component, neutral-curing silicone sealant.
2. Color: As selected by Architect.
3. Use sealants that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

F. Stone Cleaner: Cleaner specifically formulated for stone types, finishes, and applications indicated, as recommended by stone producer. Do not use cleaning compounds containing acids, caustics, harsh fillers, or abrasives.

G. Stone Sealer: Colorless, stain-resistant sealer that does not affect color or physical properties of stone surfaces, as recommended by stone producer for application indicated.

2.4 STONE FABRICATION, GENERAL

A. General: Fabricate stone per requirements, including Drawings and Shop Drawings.

1. Granite: NBGQA's "Specifications for Architectural Granite."

B. Select stone for intended use to prevent fabricated units from containing cracks, seams, and starts that could impair structural integrity or function.

1. Repairs that are characteristic of the varieties specified are acceptable provided they do not impair structural integrity or function and are not aesthetically unpleasing, as judged by Architect.

C. Grade and mark stone for final locations to produce assembled countertop units with an overall uniform appearance.

D. Fabricate stone countertops in sizes and shapes required to comply with requirements indicated, including details on Drawings and Shop Drawings.

1. Clean sawed backs of stones to remove rust stains and iron particles.
2. Dress joints straight and at right angle to face, unless otherwise indicated.
3. Cut and drill sinkages and holes in stone for anchors, supports, and attachments.
4. Provide openings, reveals, and similar features as needed to accommodate adjacent work.
5. Fabricate molded edges with machines having abrasive shaping wheels made to reverse contour of edge profile to produce uniform shape throughout entire length of edge and with precisely formed arris slightly eased to prevent snipping, and matched at joints between units. Form corners of molded edges as indicated with outside corners slightly eased, unless otherwise indicated.
6. Finish exposed faces of stone to comply with requirements indicated for finish of each type of stone required and to match approved Samples and mockups. Provide matching finish on exposed edges of countertops, splashes, and cutouts.

E. Carefully inspect finished stone units at fabrication plant for compliance with requirements for appearance, material, and fabrication. Replace defective units.

2.5 STONE COUNTERTOPS

A. General: Comply with recommendations in MIA's "Dimension Stone - Design Manual."

B. Nominal Thickness: 1 1/2 inches.

C. Edge: Straight, slightly eased at top.

D. Splashes: Provide 3/4 inch thick backsplashes and side splashes.

1. Height: As shown on Drawings.
2. Top-Edge Detail: As shown on Drawings

E. Joints: Fabricate countertops in sections for joining in field, with joints at locations shown on Drawings and as follows:

1. Joints: 1/16 inch in width.

F. Cutouts and Holes:

1. Undercounter Fixtures: Make cutouts for undercounter fixtures in shop using template or pattern furnished by fixture manufacturer. Form cutouts to smooth, even curves.
2. Counter-Mounted Fixtures: Prepare countertops in shop for field cutting openings for counter-mounted fixtures. Mark tops for cutouts and drill holes at corners of cutout locations.
3. Fittings: Drill countertops in shop for plumbing fittings, counter mounted soap dispensers, and similar items.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates indicated to receive stone countertops and conditions under which stone countertops will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

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

3.3 CONSTRUCTION TOLERANCES

A. Variation from Plumb: For vertical lines and surfaces, do not exceed 1/16 inch in 48 inches.

B. Variation from Level: Do not exceed 1/8 inch in 96 inches, 1/4 inch maximum.

C. Variation in Joint Width: Do not vary joint thickness more than 1/4 of nominal joint width.

D. Variation in Plane at Joints (Lipping): Do not exceed 1/64-inch difference between planes of adjacent units.

E. Variation in Line of Edge at Joints (Lipping): Do not exceed 1/64-inch difference between edges of adjacent units, where edge line continues across joint.

3.4 INSTALLATION OF COUNTERTOPS

A. Install countertops over plywood subtops with full spread of water-cleanable epoxy adhesive.

B. Do not cut stone in field. If stone countertops or splashes require additional fabrication not specified to be performed at Project site, return to fabrication shop for adjustment.

C. Set stone to comply with requirements shown on Drawings and Shop Drawings. Shim and adjust stone to location shown. Install countertops with uniform joints of widths shown and with edges and faces aligned.

D. Bond joints with stone adhesive and draw tight as countertops are set. Mask areas of countertops adjacent to joints to prevent adhesive smears.

E. Space joints with 1/16-inch gap for filling with sealant. Use temporary shims to ensure uniform spacing.

F. Install backsplash and end splash by adhering to wall with water-cleanable epoxy adhesive. Leave 1/16-inch gap between countertop and splash for filling with sealant. Use temporary shims to ensure uniform spacing.

G. Apply sealant to joints; comply with Division 07 Section "Joint Sealants." Remove temporary shims before applying sealant.

3.5 ADJUSTING AND CLEANING

A. In-Progress Cleaning: Clean countertops as work progresses. Remove adhesive, grout, mortar, and sealant smears immediately.

B. Remove and replace stone countertops of the following description:

1. Broken, chipped, stained, or otherwise damaged stone. Stone may be repaired if methods and results are approved by Architect.
2. Defective countertops.
3. Defective joints, including misaligned joints.
4. Interior stone countertops and joints not matching approved Samples and mockups.
5. Interior stone countertops not complying with other requirements indicated.

C. Replace in a manner that results in stone countertops matching approved Samples and mockups, complying with other requirements, and showing no evidence of replacement.

D. Following installation and after sealants are cured, clean stone countertops using clean water and soft rags.

E. Sealer Application: Apply stone sealer to comply with stone producer's and sealer manufacturer's instructions.

END OF SECTION

PART 1 GENERAL

1.1 DESCRIPTION

A. Work Included: Provide structural steel and accessories as shown on the Drawings, specified herein, and needed for a complete and proper installation.

B. Related Work:

1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division 1 of these Specifications.

1.2 QUALITY ASSURANCE

A. Use adequate number of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section. Each welder performing work on this project shall be qualified, for the type of welding to be performed, in accordance with American Welding Society Structural Welding Codes, AWS D1.1, within six months of and prior to the commencement of welding on this project. Copies of each welder's qualification records shall be submitted to the Architect. Welders shall be qualified to perform the types of welds specified in this project.

B. Perform welding with electric arc process and in accordance with AWS "Code for Arch and Gas Welding in Building Construction".

C. In addition to complying with pertinent codes and regulations, comply with:

1. AISC "Specifications for Design, Fabrication, and Erection of Structural Steel for Buildings";

2. AISC "Code of Standard Practice"; 9the Edition.

3. AISC "Specification for Structural Joints Using ASTM A325 or A490 Bolts".

D. Fabrication shall be by an AISC certified fabricator.

1.3 SUBMITTALS

A. Comply with pertinent provisions of Division 1.

B. Product date: Within 30 calendar days after the Contractor has received the Owner's Notice to Proceed, submit:

1. Sufficient technical data to demonstrate compliance with the specified requirements.

2. Complete Shop Drawings showing all members, proposed cuts, connections, camber, holes, and similar data. Drawings to be stamped by a licensed Georgia Engineer.

1.4 PRODUCT HANDLING

A. Delivery and Storage:

1. Deliver materials to the job site properly marked to identify the location for which they are intended.

2. Use markings corresponding to markings shown on the approved Shop Drawings.

3. Store in a manner to maintain identification and prevent damage, off the ground, using pallets or other supports, and to permit easy access for inspection.

PART 2 PRODUCTS

2.1 MATERIALS

A. Rolled steel beams and girders (W shapes) shall conform to ASTM A992, (Grade 50).

B. Rolled steel channels and angles, plates and bars: Comply with ASTM A36.

C. Steel Tubing: Comply with ASTM A500, Grade B, Fy = 46 ksi.

D. High Strength Bolts: Comply with ASTM A325. Anchor Bolts: Comply with ASTM F1554, 36 ksi, yield.

E. Studs: Shall conform to requirements of articles 4.26 and 4.27, AWS D1.1-98.

F. Primer: Use "1099 Tnemec Primer" or "Rustoleum number 5769 Primer" or Kenkromic Primer B50 NZ6.

G. All steel to receive fireproofing shall be bare (unprimed).

H. Rust Inhibitive Paint: Paint shall be resistant to high chlorine and moisture/vapor filled environment over the pool areas. Submit specs for selected paint for approval to the Architect, prior to its application per manufacturer=s recommendation.

2.2 MATERIAL TESTS

A. All material testing specified under Paragraph 2.01.1 shall be provided by an independent testing laboratory paid for by the Contractor. Submit the information for approval by the Testing Agency engaged by and responsible to the Architect.

B. Tests for structural steel shall be made and reports thereof furnished by the independent Testing Laboratory in accordance with the General Requirements and the Schedule Special Inspection Services shown in the drawings.

C. Test specimens shall be taken and machined by the structural steel fabricator under the direction of the independent Testing Laboratory. Specimens shall be machined to dimensions as required by the related standard ASTM specification hereinbefore designated.

D. Testing Laboratory Scheduling: The Contractor shall notify and schedule the independent testing laboratory for the times and dates required.

2.3 FABRICATION

A. Shop Fabrication and Assembly:

1. Fabricate items of structural steel in accordance with AISC specifications and as shown on the approved Shop Drawings.

2. Where finishing is required, complete the assembly, including welding of units, before start of finishing.

3. Provide finish surfaces of members exposed in the final structure free from markings, burns and other defects.

4. Grind smooth all welded connections at stairs and exposed exterior door frames.

B. Assemble and weld built-up sections by methods of which will produce true alignment of axes without warp.

C. Do not flame cut holes or enlarge holes by burning.

D. Testing: All connections and welds called for on the drawings to be full penetration butt-welds, shall be tested by the Testing Agency using radiograph or ultrasonics. These connections shall be in accordance with AWS standard specifications. All connections found to be faulty shall be reworked at the Architect's direction and at the fabricator's expense. Retesting shall be paid for by the Contractor as specified in the general requirements.

2.4 SHOP PAINTING

A. General:

1. Thoroughly clean structural steel, removing all loose mill, scale, grease, dirt and foreign matter by scraping or sandblasting.

2. Apply the specified paint to a dry film thickness not less than 1.5 mils.

B. Do Not Paint:

1. Contact surfaces in high strength bolted members.

2. Steel scheduled to be covered by sprayed-on fireproofing, scheduled to be concealed, or scheduled to be in contact with concrete.

2.5 OTHER MATERIALS

A. Provide other materials, not specifically described but required for a complete and proper installation, as selected by the Contractor subject to the approval of the Architect.

PART 3 EXECUTION

3.1 SURFACE CONDITIONS

A. Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the work. Do not proceed until unsatisfactory conditions are corrected. Field measurement on all existing dimensions is mandatory. Do not place order until all dimensions have been confirmed.

3.2 ERECTION

A. Surveys:

1. Establish permanent benchmarks necessary for accurate erection of structural steel.

2. Check elevations of concrete surfaces, and locations of anchor bolts and similar items, before erection proceeds. If found wrong, these shall be rectified by the Contractor before proceeding further.

B. Temporary Shoring and Bracing:

1. Provide temporary shoring and bracing members with connections of sufficient strength to bear imposed loads.

2. Provide temporary guy lines to achieve proper alignment of the structure as erection proceeds.

3. Remove temporary connections and members when permanent members are in place and final connections are made.

4. Contractor is solely responsible on all temporary shoring for the safety.

C. Anchor Bolts:

1. Install anchor bolts and other connectors required for securing structural steel to adjacent work.

2. Provide templates and other devices as needed for presetting bolts and other anchors to accurate locations.

D. Setting Bases and Bearing Plates:

1. Clean masonry bearing surfaces free from bond-reducing materials, and when roughen to improve bond to surface.

2. Clean the bottom surface of base and bearing plates.

3. Set loose and attached base plates and bearing plates for structural members in wedges or other adjusting devices.

4. Tighten anchor bolts after supported members have been positioned and plumbed.

5. Do not remove wedges or shims but, if protruding, cut off flush with the edge of the base or

bearing plate prior to packing with grout.

6. Pack grout solidly between bearing surfaces and bases or plates to assure that no voids remain.

7. Finish exposed surfaces, protect installed materials, and allow to cure in strict compliance with the manufacturer's recommendations by the Architect.

E. Field Assembly:

1. Set structural frames accurately to the lines and elevations indicated.

2. Align and adjust the members forming part of a complete frame or structure before fastening permanently.

3. Clean the bearing surfaces and other surfaces which will be in permanent contact before assembly.

4. Adjust as required to compensate for discrepancies in elevation and alignment.

5. Level and plumb individual members of the structure within specified AISC tolerances.

6. Establish required leveling and plumbing measurements on the mean operating temperature of the structure, making allowances for the difference between temperature at time of erection and the mean temperature at which the structure will be when completed and in service.

7. Comply with AISC specifications for bearing, adequacy of temporary connections, alignment, and removal of paint on surfaces adjacent to welds.

F. Gas Cutting:

1. Do not use gas cutting torches for correcting fabricating errors in structural framing, except on secondary members where appearance acceptable to the Architect.

2. When gas cutting is permitted, finish the gas cut section to a sheared appearance acceptable to the Architect.

3.3 INSPECTION AND TESTING

A. All inspection and testing required under Paragraph 3.03 shall be provided by an independent Testing Agency in compliance with ASTM E 329 and employed and paid directly by the Owner.

B. Ultrasonic testing shall be done in accordance with AWS D1.1, paragraph 6.13.

C. Non-destructive testing of full penetration welds shall be ultrasonic tested as follows:

1. 25 percent of all project beam-to-column joints randomly selected.

D. Full-time Field and Shop Inspection shall consist of:

1. Verification of qualifications and certifications of all welders before they perform any welding.

2. The independent laboratories shall verify that the procedures for welding as outlined in the

fabricator's overall welding procedures are followed.

3. Review of all joints in the shop and field for preparation and fit up prior to beginning of welding.

4. Maintain constant review of procedures used by each welder to insure that each individual is performing according to previously established procedures.

5. Perform the ultrasonic, radiographic and/or visual inspection specified herein to verify that all welds are within the tolerances outlined herein.

6. Daily reports shall be maintained, identifying the location and member of each test, amount of work performed, problems and solutions that arise each day, instructions to the Contractor, weather conditions, names of all welders on the job, and any other information necessary to define the work performed in a given day. Two copies if the above report shall be forwarded to the Architect on a weekly basis. One copy of the daily report shall be given to the Contractor on a daily basis.

E. High-strength field bolt inspection in accordance with AISC Specifications of Structural Joints using ASTM A325 or A490 Bolts, Chapter 6 Inspection. Testing Agency shall determine, with the proper inspection device, that the required initial tension has been achieved during installation on 30 percent of the bolted connections randomly selected.

F. The Fabricator shall furnish all necessary joint preparation, staging, platforms and ladders required for the ultrasonic equipment, and easy access to the connections to be tested.

G. The Fabricator shall coordinate required inspections with the Contractor, laboratory, fabrication shop, and erector to keep testing costs to a minimum.

H Architect and Testing Agency shall be allowed access to the fabrication shop and project.

I. All inspections and tests shall be made in accordance with AWS by use of non-destructive methods such as ultrasonic and magnetic particles. Surface preparation or non-destructive testing will be performed by the Fabricator as required by the Testing Agency. All connections not certified by Testing Agency shall be replaced and retested without additional cost to the Owner.

3.4 PAINTING

A. Secure all required approvals of welding and connections prior to application of field primer.

B. Notify the Architect when the work of this Section is ready to receive primer.

C. Prime coat structural steel and fittings, except galvanizing items, which will be enclosed or concealed in the finished work.

1. Prepare surfaces by removing loose rust, loose mill scale, and splatter, slag, and flux deposits.

2. Clean steel in accordance with Steel Structures Painting Council SP-3, "Power Tool Cleaning".

3. After erection, clean spots and surfaces where paint has been removed, damaged, or burned off, and clean field bolts and other field connections not concealed in the finished work.

4. Remove dirt, oil and grease.

5. Apply a spot coat of the approved primer.

6. Do not apply paint to wet, damp, oily or improperly prepared surfaces.

7. Spray apply the primer, filling joints and corners and covering surfaces with a smooth unbroken film of at least 1.5 dry mils thickness.

END OF SECTION

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and other Division 1 Specifications, apply to this Section.

B. Related sections:

1. Section 05120: Structural Steel.

2. Section 05310: Metal Roof Deck.

3. Section 05320: Metal Floor Deck.

2.1 DESCRIPTION

A. Qualifications of Fabricator: Fabricator shall be a member of the Steel Joist Institute and have not less than 5 years experience in fabrication of steel joists for projects of similar size and complexity.

B. Qualifications of Erector: Erector shall have not less than 3 years of experience in erection of steel joists for projects of similar size and complexity.

C. Qualifications of Welding Procedures, Welders, Welding Operators and Tackers shall be in accord with AWS D1.1-98.

D. Responsibility: Fabrication, erection and protection of steel joists in accord with the Contract Documents is the Contractor's responsibility.

E. Industry Standards and Reference Specifications:

1. American Institute of Steel Construction (AISC):

2017	Specification for the Design, Fabrication and Erection of Structural Steel for Buildings and Commentary.

2. Steel Joist Institute (SJI):

1994	Standard Specifications, Load Tables and Weight Tables for Steel Joists and Joist Girders

3. American Society for Testing and Materials (ASTM):

E329-05a	Standard Specifications for Agencies Engaged in the Testing and Inspection of Materials Used in Construction

1.3 INSPECTION

A. Inspection and tests shall be performed by an independent laboratory complying with ASTM E329 and selected and engaged by and responsible to the Architect. All material to be furnished shall be subject to inspections and tests in the shop and field.

1. Shop inspections and tests shall include fit-up, preparation of surfaces and welding.

2. Field inspections and tests shall include fit-up, preparation of surface, welding and bolting.

B. Reports of shop and field inspections and testing shall be made by the laboratory on a weekly basis.

1.4 SUBMITTALS

A. Notarized affidavit shall accompany shop drawings stating that fabricator is a member of SJI and that joists will be manufactured in accordance with SJI Specifications. Drawings to be stamped by licensed Georgia engineer.

B. Shop and Erection Drawings shall include the following:

1. Layout and placement plans and details. (Plans minimum 1/8" = 1'-0" scale).

2. Details of anchoring.

3. Details of bridging.

4. Details of joist extensions.

5. Details of ceiling extensions.

6. Type of paint.

7. Details for special joists (special loads as shown on the Drawings).

C. Manufacturer's Standard Installation Instructions amended to comply with provisions of this project. The term "manufacturer's Instructions" used in this section refers to this submission unless otherwise noted on the Drawings.

1.5 JOB CONDITIONS

A. Deliver, store and handle joist in accordance with the SJI Standard Specifications.

B. Contractor shall inspect job in accord with provisions of other sections of these specifications for conditions which would prevent execution of this work as specified. Do not proceed until such conditions have been corrected.

PART 2 PRODUCTS

2.1 GENERAL

A. Materials shall be of domestic manufacturer, within trade tolerances, new and undamaged.

B. Steel for joist members shall be in accordance with the SJI Standard Specifications for the joist series indicated on the Drawings.

C. Steel for bridging, bearing plates and miscellaneous items shall be in accordance with STRUCTURAL STEEL Section.

D. Paint shall be in accordance with the SJI Standard Specifications.

PART 3 EXECUTION

3.1 FABRICATION

A. Fabricate joists in accordance with the SJI Specifications and as follows:

1. Make shop connections and splices using either arc or resistance welding. Shop bolted connections are not acceptable.

2. Do Not splice principal tension members; use only full length pieces.

3. Camber: Design and fabricate steel joists for a camber equal to the recommended camber contained in the SJI Standard Specifications. Chord shall be parallel unless otherwise indicated.

B. Holes in Chord Members: Provide holes in chord members where shown for securing other work to joists; however, deduct area of holes from area of chord when calculating strength of member.

C. Extended Ends: Provide extended ends on joists where shown complying with manufacturer's standards and requirements of SJI Specifications and load tables.

D. Ceiling Extension: Provide ceiling extensions in areas having ceiling attached directly to joist bottom chord. Provide either an extended bottom chord element or a separate unit, to meet manufacturer's standards, of strength to support ceiling construction. Extend ends to within 1 inch of finished wall surface.

E. End anchorage shall be in accordance with SJI Specifications unless otherwise indicated on the Drawings.

3.2 SHOP PAINTING

A. Remove loose scale, rust and other foreign materials from fabricated joists and accessories before application of shop paint.

B. Apply one coat of steel joist primer paint to steel joists and accessories, by spray or dipping to provide a continuous dry paint film thickness of not less than 0.50 mil, unless otherwise called for on the drawings or in these Specifications.

3.3 ERECTION

A. Place and secure steel joists in accordance with SJI Specifications and as herein specified.

B. Do not start placement of steel joists until supporting work is in place and secured. Place joists on supporting work to achieve end bearing indicated on final shop drawings. Adjust and align in accurate location and spacing before permanently fastening.

C. Provide temporary bridging, connections and anchors to provide lateral stability during construction.

D. Provide horizontal or diagonal type bridging complying with SJI Specifications, unless otherwise indicated on the Drawings.

E. Install bridging immediately after joist erection, before any construction loads are applied. Anchor ends of bridging lines at top and bottom chords where terminating at walls and beams.

F. Field weld joists to supporting steel framework in accordance with SJI Specifications for type of joists used. Coordinate welding sequence and procedures with placing of joists.

G. Joists shall not be field modified.

H. Provide steel bearing plates to obtain required end bearing length at narrow flange width beams. Coordinate with structural steel work.

I. Material damaged during manufacture, transit or erection shall be immediately removed from the project site and replaced at no cost to the Owner.

J. Material shall be stored above the ground on platforms, skids or supports keeping it free of dirt, grease and foreign matter and shall be protected from corrosion.

3.4 TOUCH-UP PAINTING

A. Clean and touch-up paint field welds, abraded areas, and rust spots of prime coat using same paint as for shop priming.

END OF SECTION

PART 1 - GENERAL

1.1 DESCRIPTION

A. Work includes, but is not necessarily limited to:

1. Furnishing all labor, materials, tools and equipment necessary for the fabrication and erection of metal decking in accordance with the Contract Drawings and these Specifications.

2. Furnish all loose and miscellaneous items such as: closure strips, ridge and valley plates, roof sump pans, welding washers, etc., not specified in other sections.

B. Work related but specified elsewhere includes:

1. Miscellaneous metals.

2. Field painting.

3. Structural steel.

1.2 QUALITY ASSURANCE

A. Codes and Standards:

Comply with the provisions of the following codes and standards, except as otherwise shown or specified:

a. AISI "Specification for the Design of Cold Formed Steel Structural Members."
b. AWS "Structural Welding Code." AWS D1.3.
c. SDI Publication No. 28 - Steel Deck Institute Design Manual for Composite Decks, Form Decks, Roof Decks.
d. American Society for Testing and Materials (ASTM), Standards as referenced herein.

B. Qualification of Welding Work:

1. Welders employed on the work shall have passed qualification test within the past 12 months in the position for which qualified, using test procedures covered in the AWS D1.1.

2. Contractor shall require any welder to retake the qualification test when, in the opinion of the Architect, the work of the welder creates a reasonable doubt as to the proficiency of the welder. Re-qualification tests shall be conducted at no additional expense to the Owner. Re-certification shall be made to Architect after the welder has passed the pretest.

3. Each shop and field welder shall be assigned an identifying symbol, and all welds made by him shall be so identified.

1.3 PERFORMANCE REQUIREMENTS

A. Compute the properties of metal deck section on the basis of the effective design width as limited by the provisions of the AISI Specifications. Provide not less than the deck section properties shown, including section modules and moment of inertia per foot of width.

B. Allowable Deflection: design and fabricate deck for a maximum deflection of 1/240 of the clear span under the total uniform dead and live load.

C. Uplift Loading: install and anchor roof deck units to resist net uplift loading of 15 lbs. per sq. ft. for roof areas, unless indicated otherwise on drawings.

1.4 SUBMITTALS

A. Product data: Submit manufacturer's produce description and installation instructions. Indicate deck configurations, weights and structural characteristics.

B. Shop Drawings: indicate decking layout and framing details dimensions, cuts, and holes and connections to adjacent members. Indicate welding patterns, with weld symbols in accord with standard AWS welding symbols.

C. Welder qualifications: Submit evidence that welders employed in the work are currently certified under AWS qualification procedures.

1.5 DELIVERY, STORAGE AND HANDLING

Store metal deck with one end elevated for drainage. Reject materials which are damaged or corroded.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Steel with a minimum yield strength of 33000 psi. ASTM A446, Grade A, B, C, D, E, or F, or ASTM A611, Grade C, D, or E.

B. Miscellaneous Steel Shapes: ASTM A36.

C. Galvanizing: ASTM A525, G690 (0.90 oz. per sq. ft.)

D. Galvanizing Repair Paint: high zinc-dust content for repair of damaged galvanized surfaces complying with Military Specifications MIL-P-21035 (Ships).

D. Flexible Closure Strips for Deck: manufacturer's standard closed-cell, synthetic rubber.

2.2 FABRICATION

A. General: form deck units in lengths to span 3 or more supports with flush, telescoped or nested 2" end laps and nesting side laps, unless otherwise indicated. Provide deck configurations complying with SDI "Basic Design Specifications," and as specified herein.

B. Roof Sump Pans: fabricate from a single piece of not less than 14 gage galvanized sheet steel of the same quality as the deck units; with level bottoms and sloping sides to direct water flow to the drain, unless otherwise shown. Provide sump pans of adequate size to receive roof drains and with bearing flanges not less than 3" wide. Recess panes not less than 1~" below the roof deck surface, unless otherwise shown or required by deck configuration. Holes for drains will be cut in the field.

C. Ridge and Valley Plates: fabricate ridge and valley plates of galvanized sheet steel of the same quality as the deck units; each leg not less than 2%" wide, bent to provide tight-fitting closure with deck units. Provide plates in 10' lengths where possible.

D. Metal Closure Strips: fabricate metal closure strips of not less than 20 gage galvanized sheet steel of the same quality as the deck units. Form to the configuration required to provide tight-fitting closures at open ends and sides of decking.

PART 3 - EXECUTION

3.1 INSPECTION

Installer must examine the areas and conditions under which metal decking items are to be installed and notify in writing of conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to the Installer.

3.2 INSTALLATION

A. General: Install deck units and accessories in accordance with manufacturer's recommendations and final shop drawings, and as specified herein. Deck units shall be installed prior to installation of any concrete or masonry supported on structural steel beams.

B. Placing Deck Units:

1. Place deck units on supporting steel framework and adjust to final

position with ends bearing on supporting members and accurately aligned end to end before being permanently fastened. Lap ends not less than 2". Do not stretch or contract the side-lap interlocks. Place deck units flat and square, secured to adjacent framing without warp or excessive deflection. Do not place deck units on any concrete supporting structure until concrete has cured properly and is dry.

2. Coordinate and cooperate with structural steel erector in locating decking bundles to prevent overloading of structural members. Do not use deck units for storage or working platforms until permanently secured.

C. Fastening Deck Units:

1. Unless noted on drawings, permanently fasten deck units to steel supporting members by not less than 1/2" diameter fusion welds, or elongated welds of equal strength, not more than 12" o.c. at supports.
2. Use welding washers for welding deck thinner than 22 gage to steel supporting members.
3. Comply with AWS requirements and procedures for manual shielded metal arc welding, the appearance and quality of welds, and the methods used in correcting welding work.
4. Unless noted on drawings, provide a minimum lock of side laps between adjacent deck units at intervals not exceeding 36" o.c. by welding, button punching, or screws.
5. When shown on drawings, fastening of deck units shall be governed by data shown on drawings.

D. Cutting and Fitting: Cut and fit deck units and accessories around other work projecting through or adjacent to the decking, as shown on the drawings. Provide neat, square and trim cuts.

E. Reinforcement at Openings:

1. Provide additional metal reinforcement and closure pieces as required for strength, continuity of decking and support of other work, unless otherwise shown.
2. Reinforce decking around openings less than 15" in any dimension by means of a flat steel sheet placed over the opening and fusion welded to the top surface of the deck. Provide steel sheet of the same quality as the deck units, not less than 20 gage, and at least 12" wider and longer than the opening. Provide welds at each corner and spaced not more than 12" o.c. along each side.

F. Roof Sump Pans: place roof sump pans over openings provided in the roof decking and weld to the top decking surface. Space welds not more than 12" o.c. with at least one weld at each corner. Cut opening in the bottom of the roof sump to accommodate the drain size indicated.

G. Ridge and Valley Plates: weld ridge and valley plates to the top surface of the roof decking. Lap end joints not less than 3", with the laps made in the direction of water flow.

H. Closure Strips: provide metal closure strips at all open uncovered ends and edges of roof decking, and in the voids between decking and other construction.

I. Roof Insulation Support: provide metal closure strips for the support of roof insulation where the rib openings in the top surface of roof decking occur adjacent to edges and openings. Weld closure strips into position.

J. Touch-up Painting:

1 After decking installation, wire brush, clean and paint scarred areas, welds and rust spots on the top and bottom surfaces of decking units and supporting steel members.
2. Touch-up galvanized surfaces with galvanizing repair paint applied in accordance with the manufacturer's instructions.
3. In areas where touch-up painted surfaces are to be exposed, apply the paint to blend into the adjacent surfaces in a manner that will minimize visual discontinuity in the coatings.

END OF SECTION

PART 1 GENERAL

1.1 SCOPE OF WORK

A. The Contractor shall furnish all labor, materials, equipment and incidentals and install metal roof decking as shown on the Drawings and as specified herein.

1.2 RELATED WORK

A. Section 05120: Structural Steel.

B. Section 05210: Steel Joists.

1.3 QUALITY ASSURANCE

A. Acceptable Manufacturers: Vulcraft, Consolidated Systems Inc., or United Steel Deck, Inc..

B. Erector Qualifications: Minimum of 5 years experience on comparable roof deck projects.

C. Design Criteria:

1. For Decking Use: SDI Steel Roof Deck Design Manual.

2. Minimum Yield Strength 33,000 psi.

3. Maximum Working Stress: 60% minimum yield strength with a maximum of 20,000 psi.

4. Moment Coefficient:

   a. Simple and Dual Spans: 1/8.

   b. Three or More Spans: 1/10.

5. Deflection Coefficient:

   a. Simple Span: 5/384.

   b. Two or More Spans: 3/384.

6. Maximum Deflection Under Live Load: 1/240 span length, center to center to supports.

D. Allowable Tolerances: Maximum variation in unit alignment 1/4 in. in 40 ft. (1/1920).

E. Minimum Design Thickness: 0.0295 in (22 GA, Wide Rib).

1.4 SUBMITTALS

A. Shop Drawings:

1. Deck layout, framing and supports, with unit dimensions and sections.

2. Type and location of welds.

3. Details of accessories, showing cant strips, closure strips and insulation supports.

B. Manufacturer's Literature: Recommended installation instructions.

1.5 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Metal Deck:

1. Do not bend or mar decking.

2. Store off ground with one end elevated for drainage.

3. Cover deck with waterproof material.

PART 2 PRODUCTS

2.1 MATERIALS

A. Galvanized Steel: ASTM A653, Structural Quality grade 33 or higher.

B. Structural Steel: ASTM A36.

C. Galvanized Repair Paint: MIL-P-21035.

D. Flexible Closure Strips: As provided by roof deck manufacturer.

E. Provide bare (Unpainted, unprimed) steel for all areas scheduled to receive spray fireproofing.

F. Galvanizing to be G60 for Metal Deck over all other areas.

2.2 FABRICATION

A. General:

1. Form deck units in length to span three or more support spacings, with flush, telescoped, or nested 2 in. end laps resting over steel framing and adjacent side units staggered.

2. Wide Rib:

a. Depth approximately 1 1/2 inches.

b. Ribs spaced approximately 6 inches. o.c.

c. Width of rib opening at roof surface not more than 2-1/2 inches.

d. Width of bottom rib surface not less than 1-3/4 inches.

B. Metal Closure Strips:

1. Fabricate of galvanized sheet steel of same quality as deck units.

2. Minimum thickness before galvanizing 0.0478 in. (18 ga.).

3. Bend to provide tight-fitting closures at open ends and sides of decking and all openings.

C. Roof Sump Pans: Roof sump pans shall be placed over openings in the roof ducting and fusion welded to the top surface of roof decking.

PART 3 EXECUTION

3.1 INSPECTION

A. Check supporting members for correct layout and alignment.

B. Verify that surfaces to receive roof deck are free of debris.

C. Do not proceed with installation until defects are corrected.

D. All welding performed under this section shall be subject to inspection and testing by an independent Testing Agency selected and engaged by, and responsible to the Architect.

3.2 INSTALLATION

A. General: Install roof deck units and accessories in accordance with manufacturer's recommendations and shop drawings.

B. Placing Roof Deck Units:

1. Position roof deck units on supporting steel framework and adjust to final position with ends bearing on supporting members and accurately aligned end to end before being permanently fastened.

2. Lap ends not less than 2 in.

3. Do not stretch or contract the side lap interlocks.

4. Place deck units flat and square, and secure to adjust framing without warp or deflection.

C. Fastening Deck Units:

1. Secure roof deck units to supporting members with 5/8 inch puddle welds as called for on the drawings.

2. Welding to conform to AWS D1.3.

3. Fasten side laps between adjacent deck units in accordance with the drawings.

D. Joint Sealing:

1. Remove dust, dirt and moisture from joint surfaces.

2. Apply sealant in accordance with manufacturer's instructions.

E. Cutting and Fitting:

1. Cut and fit roof deck units and accessories around projections through roof decking.

2. Make cuts neat, square and trim.

3. Cut openings in roof deck true to dimensions using metal saws, drills or cutting torches.

4. Do not use cutting torches.

F. Closure Strips:

1. Install metal closure strips at all open uncovered ends and edges of roof decking, and in voids between decking and other construction.

2. Weld into position to provide complete decking installation.

G. Roof Insulation Support:

1. Provide metal closure strips for support of roof insulation where rib openings in top surface of roof decking occur adjacent to edges and openings.

2. Weld closure strips into position.

H. Touch-Up Painting:

1. Wire brush, clean and paint scarred areas, welds and rust spots on top and bottom surfaces of decking units and supporting steel members.

2. Touch-up galvanized surfaces with galvanized repair paint applied in accordance with manufacturer's instructions.

3. Touch-up shop painted surfaces same paint used in shop, and apply as recommended by manufacturer.

4. Touch-up paint to match existing paint in exposed areas.

I. Welding shall be done by welders qualified by AWS D1.3. Submit copies of welders qualification record to the Architect.

3.3 PROTECTION

A. Do not use deck units for storage or working platforms until permanently secured in position.

B. Assure that construction loads do not exceed carrying capacity of deck.

END OF SECTION

PART 1 GENERAL

1.1 SCOPE OF WORK

A. The Contractor shall furnish all labor, materials, equipment and incidentals and install metal roof decking as shown on the Drawings and as specified herein.

1.2 RELATED WORK

A. Section 05120: Structural Steel.

B. Section 05210: Steel Joists.

1.3 QUALITY ASSURANCE

A. Acceptable Manufacturers: Vulcraft, Consolidated Systems Inc., or United Steel Deck, Inc..

B. Erector Qualifications: Minimum of 5 years experience on comparable roof deck projects.

C. Design Criteria:

1. For Decking Use: SDI Steel Roof Deck Design Manual.

2. Minimum Yield Strength 33,000 psi.

3. Maximum Working Stress: 60% minimum yield strength with a maximum of 20,000 psi.

4. Moment Coefficient:

   a. Simple and Dual Spans: 1/8.

   b. Three or More Spans: 1/10.

5. Deflection Coefficient:

   a. Simple Span: 5/384.

   b. Two or More Spans: 3/384.

6. Maximum Deflection Under Live Load: 1/240 span length, center to center to supports.

D. Allowable Tolerances: Maximum variation in unit alignment 1/4 in. in 40 ft. (1/1920).

E. Minimum Design Thickness: 0.0295 in (22 GA, Wide Rib).

1.4 SUBMITTALS

A. Shop Drawings:

1. Deck layout, framing and supports, with unit dimensions and sections.

2. Type and location of welds.

3. Details of accessories, showing cant strips, closure strips and insulation supports.

B. Manufacturer's Literature: Recommended installation instructions.

1.5 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Metal Deck:

1. Do not bend or mar decking.

2. Store off ground with one end elevated for drainage.

3. Cover deck with waterproof material.

PART 2 PRODUCTS

2.1 MATERIALS

A. Galvanized Steel: ASTM A653, Structural Quality grade 33 or higher.

B. Structural Steel: ASTM A36.

C. Galvanized Repair Paint: MIL-P-21035.

D. Flexible Closure Strips: As provided by roof deck manufacturer.

E. Provide bare (Unpainted, unprimed) steel for all areas scheduled to receive spray fireproofing.

F. Galvanizing to be G60 for Metal Deck over all other areas.

2.2 FABRICATION

A. General:

1. Form deck units in length to span three or more support spacings, with flush, telescoped, or nested 2 in. end laps resting over steel framing and adjacent side units staggered.

2. Wide Rib:

a. Depth approximately 1 1/2 inches.

b. Ribs spaced approximately 6 inches. o.c.

c. Width of rib opening at roof surface not more than 2-1/2 inches.

d. Width of bottom rib surface not less than 1-3/4 inches.

B. Metal Closure Strips:

1. Fabricate of galvanized sheet steel of same quality as deck units.

2. Minimum thickness before galvanizing 0.0478 in. (18 ga.).

3. Bend to provide tight-fitting closures at open ends and sides of decking and all openings.

C. Roof Sump Pans: Roof sump pans shall be placed over openings in the roof ducting and fusion welded to the top surface of roof decking.

PART 3 EXECUTION

3.1 INSPECTION

A. Check supporting members for correct layout and alignment.

B. Verify that surfaces to receive roof deck are free of debris.

C. Do not proceed with installation until defects are corrected.

D. All welding performed under this section shall be subject to inspection and testing by an independent Testing Agency selected and engaged by, and responsible to the Architect.

3.2 INSTALLATION

A. General: Install roof deck units and accessories in accordance with manufacturer's recommendations and shop drawings.

B. Placing Roof Deck Units:

1. Position roof deck units on supporting steel framework and adjust to final position with ends bearing on supporting members and accurately aligned end to end before being permanently fastened.

2. Lap ends not less than 2 in.

3. Do not stretch or contract the side lap interlocks.

4. Place deck units flat and square, and secure to adjust framing without warp or deflection.

C. Fastening Deck Units:

1. Secure roof deck units to supporting members with 5/8 inch puddle welds as called for on the drawings.

2. Welding to conform to AWS D1.3.

3. Fasten side laps between adjacent deck units in accordance with the drawings.

D. Joint Sealing:

1. Remove dust, dirt and moisture from joint surfaces.

2. Apply sealant in accordance with manufacturer's instructions.

E. Cutting and Fitting:

1. Cut and fit roof deck units and accessories around projections through roof decking.

2. Make cuts neat, square and trim.

3. Cut openings in roof deck true to dimensions using metal saws, drills or cutting torches.

4. Do not use cutting torches.

F. Closure Strips:

1. Install metal closure strips at all open uncovered ends and edges of roof decking, and in voids between decking and other construction.

2. Weld into position to provide complete decking installation.

G. Roof Insulation Support:

1. Provide metal closure strips for support of roof insulation where rib openings in top surface of roof decking occur adjacent to edges and openings.

2. Weld closure strips into position.

H. Touch-Up Painting:

1. Wire brush, clean and paint scarred areas, welds and rust spots on top and bottom surfaces of decking units and supporting steel members.

2. Touch-up galvanized surfaces with galvanized repair paint applied in accordance with manufacturer's instructions.

3. Touch-up shop painted surfaces same paint used in shop, and apply as recommended by manufacturer.

4. Touch-up paint to match existing paint in exposed areas.

I. Welding shall be done by welders qualified by AWS D1.3. Submit copies of welders qualification record to the Architect.

3.3 PROTECTION

A. Do not use deck units for storage or working platforms until permanently secured in position.

B. Assure that construction loads do not exceed carrying capacity of deck.

END OF SECTION

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and other Division 1 Specifications, apply to this Section.

B. Related Sections:

1. Section 05120: Structural Steel.

2. Section 05210: Steel Joists.

1.2 DESCRIPTION

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

B. When the materials of this Section are used as part of an assembly indicated on the Drawings in which fire-resistive construction ratings are required, demonstrate approval by Underwriters' Laboratories, Inc. and the governmental agencies having jurisdiction.

C. Welding shall be done by welders qualified by AWS D1.3. Submit copies of welder's qualification record to the Architect.

1.3 SUBMITTALS

A. Product Data: Within 20 calendar days after the Contractor has received the Owner's Notice to Proceed, submit:

1. Material list of items proposed to be provided under this Section.

2. Manufacturer's specifications and other data needed to prove compliance with the specified requirements.

3. Shop Drawings showing layout of decking, with details of materials, gages, accessories, openings, finishes, welds and other pertinent conditions.

PART 2 PRODUCTS

2.1 METAL FLOOR DECK UNITS

A. Design:

1. Design the units in accordance with AISI "Specifications for Design of Light Gage Cold-Formed Steel Structural Members" and the “Steel Deck Institute Design Manual”.

2. The unit design flexural stress for dead load plus construction load shall not exceed the yield strength multiplied by 0.6, with an upper limit of 36 ksi.

B. Properties:

1. Form from galvanized steel sheets complying with ASTM A653, with a minimum yield strength of 33,000 psi, and coat in accordance with ASTM A924, designation G60, as defined in ASTM A653.

2. Provide the pattern shown on the Drawings.

C. Acceptable Products:

1. Where indicated on drawings, floor decks shall be composite deck by Vulcraft, Consolidated Systems, Inc. or United Steel Deck, Inc. as called out on drawings.

2. Properties shall conform to the following minimum values:

Depth (Inches)	Design Thickness (inches)	Ip (in4/ft)	In (in4/ft)	Sp (in^3/ft)	Sn (in^3/ft)
1.5	0.0474	0.282	0.295	0.315	0.327

2.2 ACCESSORIES

A. Provide accessories specifically designed to be used with the metal deck system approved for this Work.

B. Provide accessories normal to the uses shown on the Drawings including, but not necessarily limited to:

1. All metal decking: Sheet metal ends, sides, and column closures as shown on the Drawings or otherwise required.

2.3 OTHER MATERIALS

A. Provide other materials, not specifically described but required for a complete and proper installation, as selected by the Contractor subject to the approval of the Architect.

PART 3 EXECUTION

3.1 SURFACE CONDITIONS

A. Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the Work. Do not proceed until unsatisfactory conditions are corrected.

3.2 INSTALLATION

A. Prior to start of installation, verify that beams are in proper alignment and that surfaces are clean for welding.

B. Place each unit on the supporting steel framework, and adjust to final position prior to permanent welding.

1. Fasten panels to each structural support by welds as called for on the Drawings, with three welds for each 30" wide panel.

2. Fasten sheet metal accessories by tack welding or screwing at 3'0" on center.

3. Connect panels together as indicated on the Drawings.

C. Complete installation in accordance with the manufacturer's recommendations as approved by the Architect.

D. All welding performed under this section shall be subject to inspection and tests by an independent Testing Agency selected and engaged by, and responsible to the Architect.

3.3 TOUCH-UP

A. Upon completion of installation, and as a condition of its acceptance, visually inspect each item installed under this Section and locate surfaces where finish was damaged.

1. Touch-up galvanized surfaces with zinc-rich primer or other galvanize repair paint approved for the purpose by the Architect.

2. Touch-up other damaged surfaces as required to return the surfaces to condition commensurate with the services required.

3. Touch-up primed surfaces, where damaged, with same primer used in fabrication.

END OF SECTION

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Load bearing formed steel stud exterior and interior framing 20 gage and heavier.
2. Cold formed steel C-shaped joists.
3. Cold formed steel ceiling joists.
4. Cold formed steel stud header wall framing and bracing supported from roof structure.
5. Cold formed deep leg track (capture track) for interior nonload-bearing steel stud partitions.

B. Related Sections:
1. Section 06100 - Rough Carpentry: Wood furring strips, plywood, and blocking.
2. Section 09250 - Gypsum Board: Non-load bearing steel stud partition framing 20 gage and lighter and gypsum board attached to cold formed metal framing.

1.2 REFERENCES

A. The publications listed below form a part of this specification to the extent referenced. Publications are referenced within the text by the basic designation only.

B. American Iron and Steel Institute (AISI):
a. North American Specification for the Design of Cold-Formed Steel Structural Members.
b. Standard for Cold-Formed Steel Framing

C. ASTM International (ASTM):
a. ASTM A 153 - Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
b. ASTM A 653 - Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
c. ASTM A 1003 - Steel Sheet, Carbon, Metallic- and Nonmetallic-Coated for Cold-Formed Framing Members
d. ASTM C 954 - Steel Drill Screws for the Application of Gypsum Board or Metal Plaster Bases to Steel Studs from 0.033 in. (0.84 mm) to 0.112 in (2.84 mm) in Thickness.
e. ASTM C 1007 - Installation of Load Bearing (Transverse and Axial) Steel Studs and Related Accessories.
f. ASTM C 1513 - Steel Tapping Screws for Cold-Formed Steel Framing Connections.

D. American Welding Society (AWS):
a. AWS D1.3 - Structural Welding Code - Steel Sheet.

E. Gypsum Association (GA):
a. GA-216 - Application and Finishing of Gypsum Board.

F. Steel Structures Painting Council (SSPC):
a. SSPC-Paint 20 - Zinc-Rich Coating Type I Inorganic And Type II Organic.

G. Steel Stud Manufactures Association (SSMA):
a. SSMA Product Technical Information.

1.3 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in the installation of cold formed metal framing components with minimum five years documented experience.

B. Install system to provide for movement of components without damage, failure of joint seals, undue stress on fasteners, or other detrimental effects when subject to seasonal or cyclic day/night temperature ranges.

C. Install system to accommodate construction tolerances, deflection of building structural members, and clearances of intended openings.

D. Qualifications for Welding Work: Qualify welding operators in accordance with Standard Qualification Procedures as required by AWS D1.1.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Section 01600 - Product Requirements: Transport, handle, store, and protect products.

B. Protect metal framing from corrosion, deformation, and other damage during delivery, storage, and handling.

C. Store and protect with waterproof covering; ventilate to avoid condensation.

D. Where framing is stored outdoors, stack materials off ground, supported on level platform, fully protected from weather.

PART 2 PRODUCTS

2.1 MATERIALS

A. Comply with AISI North American Specification for the Design of Cold-Formed Steel Structural Members and ANSI Standard for Cold-Formed Steel Framing.

B. Steel Sheet: ASTM A 1003, Structural Grade, Type H, metallic coated, Grade: ST33H (33 ksi) unless otherwise indicated, Coating G60.

C. Material Thickness: Gage shown on the drawings shall have the following minimum base metal thickness.
1. 20 gage: 33 mils
2. 18 gage: 43 mils
3. 16 gage: 53 mils

D. Interior and Exterior Load-Bearing Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, depth, flange width, and gage as indicated on Drawings.

a. Interior and Exterior Load-Bearing Steel Joists: Manufacturer's standard C-shaped steel joists, of web depths indicated,with stiffened flanges.

E. Partition Floor Tracks and Runners: Galvanized sheet steel, C-shaped; same depth and gage as studs; tight fit; solid web.

F. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with unstiffened flanges, and same minimum base-metal thickness as steel studs.

G. Deflection (Capture) Track: Deep-leg, U-shaped steel track; unpunched, with unstiffened flanges, of web depth as shown to contain studs while allowing free vertical movement, with flanges or legs as shown designed to support horizontal and lateral loads. Provide fasteners as

indicated on Drawings.

1. Contractor's Option: Manufacturer's standard double or single deflection track as follows:
   a. VertiClip or VertiTrack by The Steel Network, Raleigh, NC (888) 474-4876. If this option is used, track may be 20 guage for all stud sizes.
   b. FastTop Clip by Dietrich Metal Framing, Pittsburg, PA (412) 281-2805.
   c. SLP-TRK by Brady Innovations as distributed by Dietrich Metal Framing.

H. Wall Furring and Partition Bracing: Galvanized sheet steel.
1. Cold-Rolled Channels: 3/4 inch x 1/2 inch and 1-1/2 inch x 17/32 inch or as shown on the drawings.
2. Clip Angles: 2 inches x 2 inches x 16 gage x 1/4 inch less than stud width or
   a. Bridge Clip by The Steel Network.
   b. EasyClip U-Series Clip Angles 1-1/2" x 1-1/2" x 16 gage x 1/4 inch less than stud width by Dietrich Metal Framing.
3. Contractor's Option: In leiu of cold rolled channels and clip angles for horizontal bridging, provide one of the following:
   a. Bridge Bar by the Steel Network.
   b. TradeReady Spazzer 5400 or 9200 bridging and spacing bar by Dietrich Metal Framing.

I. Framing Attachment Angles: Galvanized sheet steel, size, shape and configuration as indicated on Drawings, 14 gage, unless indicated otherwise on Drawings.
1. Contractor's Option: Contact Dietrich Clip Express (330) 372-5564 for alternative selections.

J. Ceiling Joists and Runners: Galvanized sheet steel, C-shaped.

K. Flat Metal Straps and Plates: Galvanized sheet steel, gage, shape, and configuration as indicated on Drawings.
1. Contractor's Option: In leiu of 2-inch continuous metal strap at capture tracks, Contractor may provide one of the following:
   a. Bridge Bar by The Steel Network.
   b. TradeReady Spazzer 5400 bridging and spacing bar by Dietrich Metal Framing

2.2 FASTENERS

A. 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.

B. Mechanical Fasteners: ASTM C 1513, corrosion-resistant-coated, self-drilling, self-tapping steel drill screws.

C. Framing to Framing: ASTM C 1513; 5/8 inch Type S-12 low-profile head corrosion-resistant self-drilling self-tapping steel screws.

D. Framing to Attachment Angle Fasteners: #12 diameter pan head corrosion-resistant self-drilling self-tapping steel screws.

E. Wall Floor Track Anchorage Device: Carbon steel wedge type expansion anchor; minimum 3/8 inch diameter x minimum 1-1/2 inch embedment.
1. Kwik Bolt KB II 38-3, by Hilti, Tulsa, OK (800) 879-8000.
2. Thrubolt WS-3822, by ITW Ramset/Red Head, Wood Dale, IL (708) 350-1558.

F. Wall Furring to Concrete or Masonry Wall Fasteners: Hex head sleeve anchors; minimum 1/4

inch diameter x minimum 1-1/8 inch embedment.
1. Slv Anch HX 5/16X2-1/2, by Hilti or equal.
2. Dynabolt HN-1413, by ITW Ramset/Redhead or equal.

G. Furring Channel to Masonry or Concrete Surface Fasteners: Low velocity powder-actuated drive pins of size to suit application.

H. Welding Materials: AWS D1.3.

I. Wood Furring, Blocking, and Plywood, Attached to Framing Fasteners: Specified in Section 06100.

2.3 FRAMING ACCESSORIES

A. Fabricate steel-framing accessories from steel sheet, ASTM A 1003, Structural Grade, Type H, metallic coated, of same grade and coating weight used for framing members, unless otherwise indicated.

B. Steel Shapes and Clips: ASTM A 36, zinc coated by hot-dip process according to ASTM A 123.

2.4 FINISHES

A. Galvanizing: G60 coating class.

B. Galvanizing Repair Paint: SSPC-Paint 20, Type II - organic.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine existing conditions and adjacent areas where products will be installed and verify that conditions conform to product manufacturer's requirements. Verify that building framing components are ready to receive work. Verify that rough-in utilities are in-place and located where required. Do not proceed until unsatisfactory conditions have been corrected.

B. Beginning of erection indicates acceptance of existing conditions.

3.2 INSTALLATION, GENERAL

A. Install cold-formed metal framing in accordance with AISI Standard for Cold-Formed Steel Framing and to manufacturer's written instructions unless more stringent requirements are shown or specified.

B. Install cold-formed metal framing and accessories plumb, square, and true to line, and with connections securely fastened.

C. Install framing members in one-piece lengths.

3.3 INSTALLATION - STUD FRAMING

A. Install studs and fasteners in accordance with manufacturer's published instructions and, where gypsum board is attached to studs, install studs in accordance with GA-216 and ASTM C 1007.

B. Metal Stud Spacing: 16 inches on center, maximum, unless otherwise shown on the drawings.

C. Align stud web openings horizontally.

D. Construct corners using minimum three studs.

E. Place studs as indicated on Drawings, minimum 2 inches from abutting walls.

F. Erect studs one piece full length. Splicing of studs not permitted.

G. Erect studs, brace, and reinforce to develop full strength to meet design requirements.

H. Install headers at partition openings using load-bearing C-shaped joists.

I. Install framing between studs for attachment of mechanical and electrical items.

J. Coordinate placement of insulation in multiple stud spaces made inaccessible after erection.

K. Install intermediate studs above and below openings to match wall stud spacing.

L. Fasten studs adjacent to door and window frames, partition intersections, and corners to top and bottom runner flanges in double-stud fashion with metal lock fastener tools.
1. Securely fasten studs to jamb and head anchor clips of door and borrowed-light frames.
2. Place horizontally a cut-to-length section of runner with web-flange bent at each end, fasten with minimum one screw per flange.
3. Position a cut-to-length stud (extending to top runner) at vertical panel joints over door frame header.

M. Install bridging for stud partitions over 8 feet high at mid-height with 1-1/2 inch rolled channels through studs and screw attach in place using clip angles. Lap channels by nesting one inside the other to a length of at least 8 inches and wire fasten together.

N. Blocking: Screw attach wood blocking between studs. Install blocking for support of plumbing fixtures, toilet partitions, wall cabinets, toilet accessories, and hardware.

O. Where optional framing products by the named manufacturers are specified in Part 2 above in leiu of conventional components specified, install in accordance with manufacturers recommendations.

P. Touch up field welds and damaged galvanized surfaces with primer.

Q. Fastening: Fasten framing in accordance with manufacturer's published instructions and schedule below unless indicated otherwise on Drawings.

FASTENERS	MINIMUM CONNECTION
Floor Track to Concrete	1 Anchor at 36 inches on center.
Partition Stud to Floor Track	1 Screw each side at flange.
Stud Web to Stud Web	2 Screws.
Plates and Straps to Studs	2 Screws.
Lateral Bracing to Partition Stud Using clip Angles	2 Screws to stud and 2 Screws to cold rolled channel.
Runner to Header	1 Screw at 16 inches on center, maximum 6 inches from each end.

Welded Connections	Indicated on Drawings.

3.4 INSTALLATION - JOIST FRAMING

A. Install joists and fasteners in accordance with manufacturer's published instructions.

B. Make provisions for erection stresses. Provide temporary alignment and bracing.

C. Place joists at locations and spacing as indicated on Drawings.

D. Touch-up field welds and damaged galvanized surfaces with primer.

E. Fastening: Indicated on Drawings.

3.5 INSTALLATION - CEILING JOISTS

A. Install joists and fasteners in accordance with manufacturer's published instructions and, where gypsum board is attached to joists, install joists in accordance with GA-216, and ASTM C 1007.

B. Ceiling Joist Spacing: 16 inches on center beginning from center of room unless otherwise shown on the drawings.

C. Install joists in direction of shortest span, parallel and level, with lateral bracing and bridging.

D. Install joists in one piece full length. Splicing of joists not permitted.

E. Install perimeter joist runner track sized to match joists. Attach joist runner track to wall framing with minimum 2 screws per stud and at corners and ends.

F. Attach joist ends to joist runner tracks with minimum 1 screw each side at each flange.

G. Install bridging at 48 inches on center beginning from center of room with 1-1/2 inch rolled channels screw attached to joists.

3.6 INSTALLATION - FURRING

A. Furring Channels: Attach vertically spaced at maximum 16 inches on center, unless otherwise shown on the drawings, to masonry and concrete surfaces with specified powder driven fasteners staggered 24 inches on center on opposite flanges.

B. Wall Furring:
1. Secure top and bottom runners to structure.
2. Space metal furring at maximum 16 inches on center unless otherwise shown on the drawings.

3.7 CONSTRUCTION

A. Interface with Other Work:
1. Coordinate erection of studs with hollow metal door frames.
2. Coordinate installation of anchors, supports, and blocking for mechanical, electrical, and building accessory items installed within framing.

B. Perform field welding in accordance with AWS D1.3.

3.8 QUALITY ASSURANCE TESTING AND INSPECTION

A. Engage the services of an independent testing agency to perform the following inspections for field quality control.

B. Welding (General):
   1. Prior to start of fabrication, determine if fabrication shop meets the criteria for exempting shop welds from inspection and confirm in writing to building official and SER.
   2. Verify qualifications of all welders as AWS certified.
   3. Verify proposed welding procedures and materials.
   4. Verify adequate preparation of faying surfaces.
   5. Verify preheat and interpass temperatures of steel, proper technique and sequence of welding, and cleaning and number of passes are provided as required.

C. Welding (Field):
   1. Cold Formed Metal Framing Welds: Visually inspect 100% of welds for specified length, size, and continuity in accordance with AWS D1.3 for metal less than 1/8" in thickness, for work designed as a structural element.
   2. Miscellaneous Metals, Inserts and Prefabricated Components: Where integrity of the connections impact life safety or performance of the building structure, provide testing and inspection as for typical welds previously specified.

D. Miscellaneous Mechanical Fasteners: Visually inspect specified size, spacing, embedment, and location that are part of the building structural system.

E. Submittal Verification: Verify mill test reports and other submitted documentation for compliance with contract documents.

F. Material Verification: Verify materials delivered to site comply with contract documents and approved shop drawings. Materials include:
   1. Bolts
   2. Electrodes
   3. Mechanical fasteners

G. Verification of Detail Compatibility:
   1. Inspect on a periodic basis:
   2. Review project documents affecting integrity of the structure including contract documents and approved shop drawings.
   3. Visit site at intervals appropriate to the stage of construction to perform review of the structure and visually confirm general compliance with the contract documents.
   4. Inspect the following to verify that member orientation, configuration, type, and size comply with details indicated on the contract documents and approved shop drawings:
      a. Bracing and stiffening members.
      b. Proper applications of joint details at connections for structural members.
      c. Other work critical to the integrity of the building structure.

END OF SECTION

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 metal fabrications:
   1. Miscellaneous framing and supports for the following:
      a. Applications where framing and supports are not specified in other sections.
   2. Miscellaneous steel trim, including the following:
      a. Steel angle corner guards.
      b. Bollards.

1.3 SUBMITTALS

A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.

B. Qualification data for firms and persons specified in the "Quality Assurance" Article to demonstrate their capabilities and experience.

1.4 QUALITY ASSURANCE

A. Fabricator Qualifications: Firm experienced in producing metal fabrications similar to those indicated for this Project with a record of successful in-service performance, and with sufficient production capacity to produce required units without delaying the Work.

B. Welding Standards: Comply with applicable provisions of AWS D1.1 "Structural Welding Code--Steel," AWS D1.2 "Structural Welding Code--Aluminum," and AWS D1.3 "Structural Welding Code--Sheet Steel."
   1. Certify that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone recertification.

1.5 PROJECT CONDITIONS

A. Field Measurements: Check actual locations of walls and other construction to which metal fabrications must fit by accurate field measurements before fabrication. Show recorded measurements on final shop drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

   1. Where field measurements cannot be made without delaying the Work, guarantee dimensions and proceed with fabricating products without field measurements. Coordinate construction to ensure that actual dimensions correspond to guaranteed dimensions. Allow for trimming and fitting.

PART 2 - PRODUCTS

2.1 FERROUS METALS

A. Metal Surfaces, General: For metal fabrications exposed to view in the completed Work, provide materials selected for their surface flatness, smoothness, and freedom from surface

blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.

B. Steel Plates, Shapes, and Bars: ASTM A 36 (ASTM A 36M).

C. Rolled Steel Floor Plates: ASTM A 786 (ASTM A 786M).

D. Steel Tubing: Product type (manufacturing method) and as follows:
1. Cold-Formed Steel Tubing: ASTM A 500.
2. Hot-Formed Steel Tubing: ASTM A 501.
a. For exterior installations and where indicated, provide tubing with hot-dip galvanized coating per ASTM A 53.

E. Steel Pipe: ASTM A 53, standard weight (schedule 40), unless otherwise indicated, or another weight required by structural loads.
1. Black finish, unless otherwise indicated.
2. Galvanized finish for exterior installations and where indicated.

F. Gray-Iron Castings: ASTM A 48, Class 30.

G. Malleable-Iron Castings: ASTM A 47, Grade 32510 (ASTM A 47M, Grade 22010).

H. Cast-in-Place Anchors in Concrete: Anchors of type indicated below, fabricated from corrosion-resistant materials capable of sustaining, without failure, the load imposed within a safety factor of 4, as determined by testing per ASTM E 488, conducted by a qualified independent testing agency.
1. Threaded or wedge type; galvanized ferrous castings, either ASTM A 47 (ASTM A 47M) malleable iron or ASTM A 27 (ASTM A 27M) cast steel. Provide bolts, washers, and shims as required, hot-dip galvanized per ASTM A 153.

I. Welding Rods and Bare Electrodes: Select according to AWS specifications for the metal alloy to be welded.

2.2 PAINT

A. Shop Primer for Ferrous Metal: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with performance requirements of FS TT-P-664, selected for good resistance to normal atmospheric corrosion, compatibility with finish paint systems indicated, and capability to provide a sound foundation for field-applied topcoats despite prolonged exposure.

B. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds in galvanized steel, with dry film containing not less than 94 percent zinc dust by weight, and complying with DOD-P-21035 or SSPC-Paint 20.

C. Bituminous Paint: Cold-applied asphalt mastic complying with SSPC-Paint 12, except containing no asbestos fibers.

2.3 FASTENERS

A. General: Provide plated fasteners complying with ASTM B 633, Class Fe/Zn 25 for electrodeposited zinc coating, for exterior use or where built into exterior walls. Select fasteners for the type, grade, and class required.

B. Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade A (ASTM F 568, Property Class 4.6), with hex nuts, ASTM A 563 (ASTM A 563M), and, where indicated, flat washers.

C. Machine Screws: ANSI B18.6.3 (ANSI B18.6.7M).

D. Lag Bolts: ANSI B18.2.1 (ANSI B18.2.3.8M).

E. Wood Screws: Flat head, carbon steel, ANSI B18.6.1.

F. Plain Washers: Round, carbon steel, ANSI B18.22.1 (ANSI B18.22M).

G. Lock Washers: Helical, spring type, carbon steel, ANSI B18.21.1.

H. Expansion Anchors: Anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to 6 times the load imposed when installed in unit masonry and equal to 4 times the load imposed when installed in concrete as determined by testing per ASTM E 488 conducted by a qualified independent testing agency.
1. Material: Carbon steel components zinc-plated to comply with ASTM B 633, Class Fe/Zn 5.
2. Material: Group 1 alloy 304 or 316 stainless-steel bolts and nuts complying with ASTM F 593 (ASTM F 738M) and ASTM F 594 (ASTM F 836M).

I. Toggle Bolts: FS FF-B-588, tumble-wing type, class and style as required.

2.4 GROUT

A. 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.

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

1. Nonshrink, Nonmetallic Grouts:
   a. B-6 Construction Grout; W. R. Bonsal Co.
   b. Diamond-Crete Grout; Concrete Service Materials Co.
   c. Supreme; Cormix Construction Chemicals.
   d. Sure-grip High Performance Grout; Dayton Superior Corp.
   e. Euco N-S Grout; Euclid Chemical Co.
   f. Five Star Grout; Five Star Products.
   g. Vibropruf #11; Lambert Corp.
   h. Crystex; L & M Construction Chemicals, Inc.
   i. Masterflow 928 and 713; Master Builders Technologies, Inc.
   j. Sealtight 588 Grout; W. R. Meadows, Inc.
   k. Sonogrout 14; Sonneborn Building Products--ChemRex, Inc.
   l. Kemset; The Spray-Cure Company.

2.5 FABRICATION, GENERAL

A. Form metal fabrications from materials of size, thickness, and shapes indicated but not less than that needed to comply with performance requirements indicated. Work to dimensions indicated or accepted on shop drawings, using proven details of fabrication and support. Use type of materials indicated or specified for various components of each metal fabrication.

B. Form exposed work true to line and level with accurate angles and surfaces and straight sharp edges.

C. Allow for thermal movement resulting from the following maximum change (range) in ambient temperature in the design, fabrication, and installation of installed metal assemblies to prevent buckling, opening up of joints, and overstressing of welds and fasteners. Base design calculations on actual surface temperatures of metals due to both solar heat gain and nighttime sky heat loss.
1. Temperature Change (Range): 100 deg F (55.5 deg C).

D. Shear and punch metals cleanly and accurately. Remove burrs.

E. Ease exposed edges to a radius of approximately 1/32 inch (1 mm), unless otherwise indicated. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

F. Remove sharp or rough areas on exposed traffic surfaces.

G. Weld corners and seams continuously to comply with the following:
1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds and surfaces smooth and blended so that no roughness shows after finishing, and contour of welded surface matches those adjacent.

H. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners wherever possible. Use exposed fasteners of type indicated or, if not indicated, Phillips flat-head (countersunk) screws or bolts. Locate joints where least conspicuous.

I. Provide for anchorage of type indicated; coordinate with supporting structure. Fabricate and space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.

J. Shop Assembly: Preassemble items in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.

K. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.

L. Fabricate joints that will be exposed to weather in a manner to exclude water, or provide weep holes where water may accumulate.

2.6 LOOSE BEARING AND LEVELING PLATES

A. Provide loose bearing and leveling plates for steel items bearing on masonry or concrete construction, made flat, free from warps or twists, and of the required thickness and bearing area. Drill plates to receive anchor bolts and for grouting as required. Galvanize after fabrication.

2.7 LOOSE STEEL LINTELS

A. Fabricate loose structural steel lintels from steel angles and shapes of size indicated for openings and recesses in masonry walls and partitions at locations indicated.

B. Weld adjoining members together to form a single unit where indicated.

C. Size loose lintels for equal bearing of 1 inch per foot (85 mm per m) of clear span but not less than 8 inches (200 mm) bearing at each side of openings, unless otherwise indicated.

D. Galvanize loose steel lintels located in exterior walls.

2.8 MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Provide steel framing and supports for applications indicated that are not a part of structural steel framework as required to complete the Work.

B. Fabricate units to sizes, shapes, and profiles indicated and required to receive other adjacent construction retained by framing and supports. Fabricate from structural steel shapes, plates, and steel bars of welded construction using mitered joints for field connection. Cut, drill, and tap units to receive hardware, hangers, and similar items.
   1. Equip units with integrally welded anchors for casting into concrete or building into masonry. Furnish inserts if units must be installed after concrete is placed.
      a. Except as otherwise indicated, space anchors 24 inches (600 mm) o.c. and provide minimum anchor units in the form of steel straps 1-1/4 inches (32 mm) wide by 1/4 inch (6 mm) thick by 8 inches (200 mm) long.

C. Galvanize miscellaneous framing and supports in the following locations:
   1. Interior locations where indicated.

2.9 MISCELLANEOUS STEEL TRIM

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

B. Provide cutouts, fittings, and anchorages as required to coordinate assembly and installation with other work. Provide anchors, welded to trim, for embedding in concrete or masonry construction, spaced not more than 6 inches (150 mm) from each end, 6 inches (150 mm) from corners, and 24 inches (600 mm) o.c., unless otherwise indicated.

C. Galvanize miscellaneous steel trim in the following locations:
   1. Exterior locations.
   2. Interior locations where indicated.

2.10 STRUCTURAL STEEL DOOR FRAMES

A. Fabricate steel door frames from structural shapes and bars of size and to dimensions indicated, fully welded together, with 5/8-by-1-1/2-inch (16-by-38-mm) steel bar stops, unless otherwise indicated. Plug-weld built-up members and continuously weld exposed joints. Secure removable stops to frame with countersunk machine screws, uniformly spaced at not more than 10 inches (250 mm) o.c. Reinforce frames and drill and tap as required to accept finish hardware.

B. Provide steel strap anchors for securing door frames into adjoining concrete or masonry, using 1/8-by-2-inch (3-by-50-mm) straps of the length required for a minimum 8-inch (200-mm) embedment, unless otherwise indicated. Weld anchors to frame jambs no more than 12 inches (300 mm) from both bottom and head of frame and space anchors not more than 30 inches (750 mm) apart.

C. Extend bottom of frames to floor elevation indicated with steel angle clips welded to frames for anchoring frame to floor with expansion shields and bolts.

D. Galvanize frames and anchors in the following locations:
1. Exterior locations.
2. Interior locations where indicated.

2.11 FINISHES, GENERAL

A. Comply with NAAMM "Metal Finishes Manual" for recommendations relative to applying and designing finishes.

B. Finish metal fabrications after assembly.

2.12 STEEL AND IRON FINISHES

A. Galvanizing: For those items indicated for galvanizing, apply zinc coating by the hot-dip process complying with the following requirements:
1. ASTM A 153 for galvanizing iron and steel hardware.
2. ASTM A 123 for galvanizing both fabricated and unfabricated iron and steel products made of uncoated rolled, pressed, and forged shapes, plates, bars, and strip 0.0299 inch (0.76 mm) thick or thicker.

B. Preparation for Shop Priming: Prepare uncoated ferrous metal surfaces to comply with minimum requirements indicated below for SSPC surface preparation specifications and environmental exposure conditions of installed metal fabrications:
1. Exteriors (SSPC Zone 1B): SSPC-SP 6 "Commercial Blast Cleaning."
2. Interiors (SSPC Zone 1A): SSPC-SP 3 "Power Tool Cleaning."

C. Apply shop primer to uncoated surfaces of metal fabrications, except those with galvanized finishes or to be embedded in concrete, sprayed-on fireproofing, or masonry, unless otherwise indicated. Comply with requirements of SSPC-PA 1 "Paint Application Specification No. 1" for shop painting.
1. Stripe paint corners, crevices, bolts, welds, and sharp edges.

PART 3 - EXECUTION

3.1 PREPARATION

A. Coordinate and furnish anchorages, setting drawings, diagrams, templates, instructions, and directions for installing anchorages, including concrete inserts, sleeves, anchor bolts, and miscellaneous items having integral anchors that are to be embedded in concrete or masonry construction. Coordinate delivery of such items to Project site.

3.2 INSTALLATION, GENERAL

A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing miscellaneous metal fabrications to in-place construction. Include threaded fasteners for concrete and masonry inserts, toggle bolts, through-bolts, lag bolts, wood screws, and other connectors as required.

B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing miscellaneous metal fabrications. Set metal fabrication accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.

C. Provide temporary bracing or anchors in formwork for items that are to be built into concrete masonry or similar construction.

D. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop-welded because of shipping size limitations. Do not weld, cut, or abrade the surfaces of exterior units that have been hot-dip galvanized after fabrication and are intended for bolted or screwed field connections.

E. Field Welding: Comply with the following requirements:
1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds and surfaces smooth and blended so that no roughness shows after finishing, and contour of welded surface matches those adjacent.

F. Corrosion Protection: Coat concealed surfaces of aluminum that will come into contact with grout, concrete, masonry, wood, or dissimilar metals with a heavy coat of bituminous paint.

3.3 SETTING LOOSE PLATES

A. Clean concrete and masonry bearing surfaces of bond-reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of bearing plates.

B. Set loose leveling and bearing plates on wedges or other adjustable devices. After the bearing members 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 grout.
1. Use nonshrink, nonmetallic grout in all locations, unless otherwise indicated.
2. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

3.4 INSTALLING PIPE BOLLARDS

A. Anchor pipe bollards in concrete with pipe sleeves preset anchored into concrete. After setting bollard, fill annular space between bollard and sleeve solidly with non-shrink grout mixed and placed to comply with manufacturer’s directions.

3.5 ADJUSTING AND CLEANING

A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with same material as used for shop painting to comply with SSPC-PA 1 requirements for touching up shop-painted surfaces.

1. Apply by brush or spray to provide a 2.0-mil (0.05-mm) minimum dry film thickness.

B. For galvanized surfaces, clean welds, bolted connections, and abraded areas, and apply galvanizing repair paint to comply with ASTM A 780.

END OF SECTION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Aluminum access ladders.

1.2 RELATED SECTIONS

A. Section 05500 – Metal Fabrications: Fasteners and installation requirements used to attach ladders to structure.

1.3 REFERENCES

A. AA – Aluminum Association.

B. ASTM B 209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.

C. ASTM B 221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.

D. OSHA 1910.27 – Fixed Ladders.

1.4 SUBMITTALS

A. Submit under provisions of Section 01330.

B. Product Data: Manufacturer's data sheets on each product.

C. Shop Drawings:

1. Detail fabrication and erection of each ladder indicated. Include plans, elevations, sections, and details of metal fabrications and their connections.

2. Provide templates for anchors and bolts specified for installation under other Sections.

3. Provide reaction loads for each hanger and bracket.

D. Qualification Data:

1. Refer to Quality Assurance provisions for submittal requirements evidencing experience, certifications and resources.

E. Selection Samples: For each finish specified, two complete sets of color chips representing manufacturer's full range of available colors.

F. Verification Samples: For each finish specified, two samples, minimum size 6 inches (150

mm) square, represent actual product color.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: A firm experienced in producing aluminum metal ladders similar to those indicated for this Project.

1. Record of successful in-service performance.
2. Sufficient production capacity to produce required units.
3. Professional engineering competent in design and structural analysis to fabricate ladders in compliance with industry standards and local codes.

B. Installer Qualifications: Competent and experienced firm capable of selecting fasteners and installing ladders to attain designed operational and structural performance.

C. Product Qualification: Product design shall comply with OSHA 1910.27 minimum standards for ladders.

D. Mock-Up: Provide a mock-up for evaluation of surface preparation techniques and application workmanship.

1. Install ladder in area designated by Architect.
2. Do not proceed with remaining work until workmanship and installation are approved by Architect.
3. Rework mock-up as required to produce acceptable work.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

1.7 PROJECT CONDITIONS

A. Field Measurements: Verify dimensions by field measurement before fabrication.

1. Established Dimensions: Where field measurements cannot be made without delaying the Work, indicate established dimensions on shop drawing submittal and proceed with fabrication.

1.8 WARRANTY

A. A. Manufacturer has responsibility for an extended Corrective Period for work of this Section for a period of 5 years commencing on the shipment date of the product against all the conditions indicated below, and when notified in writing from Owner, manufacturer shall

promptly and without inconvenience and cost to Owner correct said deficiencies.

1. Defects in materials and workmanship.

2. Deterioration of material and surface performance below minimum OSHA standards as certified by independent third party testing laboratory. Ordinary wear and tear, unusual abuse or neglect excepted.

3. Within the warranty period, the manufacturer shall, at its option, repair, replace, or refund the purchase price of defective ladder.

B. Manufacturer shall be notified immediately of defective products, and be given a reasonable opportunity to inspect the goods prior to return. Manufacturer will not assume responsibility, or compensation, for unauthorized repairs or labor. Manufacturer makes no other warranty, expressed or implied, to the merchantability, fitness for a particular purpose, design, sale, installation, or use, of the ladder; and shall not be liable for incidental or consequential damages, losses of or expenses, resulting from the use of ladder products.

1.9 EXTRA MATERIALS

A. Furnish touchup kit for each type and color of paint finish provided.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturer:

1. O'Keeffe's, Inc.; 100 N Hill Drive, Suite 12, Brisbane, CA 94005. Toll Free Tel: (888) 653-3333. Tel: (415) 824-4900. Fax: (415) 824-5900. Email: info@okeeffes.com. Web: http://www.okeeffes.com.

2. ALACO Ladder Co.; 5167 G Street, Chino, CA 91710-5143. Tel: (888) 310-7040 Fax (909) 591-7565. E-mail: sales@alacoladder.com Web: www.alacoladder.com

3. Royalite Manufacturing, Inc; 1055 Terminal Way, San Carlos, CA 94070. Tel: (800) 875-9548. Fax (650) 637-9770. www.royalite-mfg.com.

C. Substitutions: Not permitted.

D. Requests for substitutions will be considered in accordance with provisions of Section 01600.

2.2 APPLICATIONS/SCOPE

A. Fixed and Cage Ladder Design:

1. Safety cages are required on ladders over 24 feet (7315 mm)

2. Safety cages are required on all ladders in high or hazardous areas.

3. Landing platforms are required at 50 feet (15,240 mm) above the bottom of the ladder.

B. Fixed Access Ladder:

1. Tubular Rail Low Parapet Access Ladder with Platform and Return.

a. Model 503 as manufactured by O'Keeffe's Inc.
b. Model 563 as manufactured by ALACO Ladder Co.
c. Model ELLSBAD as manufactured by Royalite Manufacturing, Inc.

2.3 FINISHES

A. Mill finish. As extruded.

B. Clear Anodic Finish: AA-M10C22A41 Mechanical finish as fabricated. Architectural Class I, clear coating 0.018 mm or thicker.

2.4 MATERIALS

A. Aluminum Sheet: Alloy 5005-H34 to comply with ASTM B209.

B. Aluminum Extrusions: Alloy 6061-T1 or 6063-T6 to comply with ASTM B221.

2.5 FABRICATION

A. Rungs: Not less than 1-1/4 inches (32 mm) in section and 18–3/8 inches (467mm) long, formed from tubular aluminum extrusions. Squared and deeply serrated on all sides.

1. Rungs shall withstand a 1,500 pound (454 kg) load without deformation or failure.

B. Channel Side Rails: Not less than 1/8 inch (3 mm) wall thickness by 3 inches (76 mm) wide.

C. Heavy Duty Tubular Side Rails: Assembled from two interlocking aluminum extrusions no less than 1/8 inch (3 mm) wall thickness by 3 inches (76 mm) wide. Construction shall be self-locking stainless steel fasteners, full penetration TIG welds and clean, smooth and burr-free surfaces.

D. Walk-Through Rail and Roof Rail Extension: Not less than 3 feet 6 inches (1067 mm) above the landing and shall be fitted with deeply serrated, square, tubular grab rails.

E. Landing Platform: 1-1/2 inches (38 mm) or greater diameter, tubular aluminum guardrails and decks of serrated aluminum treads.

F. Security Doors: Formed 1/8 inch (3 mm) thick aluminum sheet. Security panels shall extend on both sides, perpendicular to the door face, to within 2 inches (51 mm) of the wall. Security door shall be furnished with continuous aluminum piano hinge and heavy duty forged steel

locking hasps.

G. Ship Ladder Seismic Bottom Support: Manufacturer's standard; two isolation bearings per stringer.

H. Ladder Safety Post: Retractable hand hold and tie off.

I. Rail and Harness Fall Arrest System: Supplied where specified as alternate to safety cage and landing platforms, in accordance with OSHA regulation 1910.27; permanently mounted to ladder rungs and complete with necessary components.

J. Safety Cages:

1. Fabricate ladder safety cages to comply with authority having jurisdiction. Assemble by welding. Spacing of primary hoops, secondary hoops and vertical bars shall not exceed that required by code.

2. Safety cage hoops and vertical bars: 3/16 inch (5 mm) by 2 inches (51 mm) aluminum bar.

PART 3 EXECUTION

3.1 EXAMINATION

A. Coordinate anchorages. Furnish setting drawings, templates, and anchorage structural loads for fastener resistance.

B. Do not begin installation until supporting structure is complete and ladder installation will not interfere with supporting structure work.

C. If supporting structure is the responsibility of another installer, notify Architect of unsatisfactory supporting work before proceeding.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions and in proper relationship with adjacent construction.

3.3 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION

PART I – GENERAL

1.1 SUMMARY:

A. Section includes:
   1. Stainless steel cabinets and countertops
   2. Supplementary parts and components, such as clips, fasteners, supplementary Framing, and other miscellaneous accessories required for a complete installation.

B. Related work:
   1. Division 6 for millwork and casework.
   2. Division 7 for joint sealants.

1.2 SYSTEM DESCRIPTION:

A. Design requirements: Engineer, fabricate, assemble and install stainless steel countertops, including attachment to their supports, to meet or exceed the criteria indicated and specified, to conform to the profiles indicated and to other requirements of the Contract Documents.

1.3 SUBMITTALS:

A. Shop drawings:
   1. Submit large scale, dimensioned drawings showing materials, profiles, joints, finishes, method of fabrication and anchorage details. Label individual components and indicate materials and method of field installation.
   2. Indicate layout, methods of support, connection details, integration of plumbing components, and interface and anchorage to adjacent materials. Show position of openings required, with rough-in sizes.

1.4 QUALITY ASSURANCE:

A. Fabricator's qualifications: Firm and individuals with a minimum of 5 consecutive years experience in the fabrication and installation of specified materials on projects similar in material, design and whose work has resulted in applications with a record of successful in-service performance.

1.5 HANDLING

A. Handling: Deliver stainless steel countertop fabrications as factory-assembled units with protective crating and covering.

B. Storage: Store materials indoors, off the floor in original packaging and protected with breathing type covers.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

A. Acceptable manufacturers: Provide one of the following or approved equivalent
   1. Stainless Supply: Tel: 877.484.0088, Fax: 866.430.3134; website: www.stainlesssupply.com
   2. Eagle Group: Tel: 800-637-5100, Fax: 302-653-2065; website: www.eaglegrp.com

3. Stainless Steel Kitchens Inc.: Tel: 574-272-2530; website: stainlesssteelkitchen.com

2.2 AVAILABLE MATERIALS

A. General: Provide materials from a single source.
   1. Provide sheet metals selected for their surface flatness, smoothness and freedom from surface blemishes where exposed to view in the finished unit.
   2. Exposed surfaces which exhibit pitting, seam marks, roller marks, oil-canning, stains, discolorations, variations in flatness exceeding those permitted by referenced standards for stretcher-leveled metal sheets, or other imperfections are unacceptable.

2.3 CABINETS

A. Basis of Design: Architectural Series by Stainless Steel Kitchens.
B. Stainless Steel: Complying with the following
   1. Body: 18 ga. Type 430 #4 PVC
   2. Panels, doors, drawer fronts and end caps: 18 ga Type 304 #4 PVC
   3. Drawer boxes: 18 ga. Type 304 #4 PVC
   4. Shelves: 18 ga Type 304 #4 PVC
   5. Toe Kicks: 18 ga Type 304 #4 PVC
   6. Handles: solid stainless steel, 5/8” diameter x 6” minimum length, unless noted otherwise on drawings
   7. Hinges:
      a. Concealed 125 degree open
      b. All metal nickel
      c. Soft close feature
      d. Rated 200,000 cycles
   8. Drawer Slides:
      a. Stainless steel, full extension by Blumotion or approved equal
      b. Soft close feature
   9. Style: frameless with full overlay doors and drawers.
   10. Sloped Top: Complying with one of the following
      a. Integrated: 18 ga. Type 304
         1. Including corner units
      b. Field Fabricated:
         1. 18 ga. Type 304
         2. 3/4” plywood frame (backing)
         3. Length: match total wall cabinet length
         4. Width (wall to face): match cabinet width
         5. 1/8” reveal at bottom

2.3 COUNTERTOPS

A. Stainless Steel: Complying with the following.
   1. Bars and shapes ASTM A 276, Type 304.
   2. Sheet, strip, plate, and bar: ASTM A 666, Type 304 or ASTM A 167-81-A, Type 304.
   3. Gage(s) for sheets: Except where noted on the drawings, as necessary for the required spans and use intended without visible deflection, oil-canning and other defects.
      a. Countertops, tabletops, and back splashes: 14 ga
   4. Profiles: 1 1/2"
      a. Square edge with return
      b. Bullnose
      c. Marine edge with return
   5. Blacksplash: 4” high integrated backsplash, minimum 3/4” thick

B. Fasteners:
   1. Of same basic metal and alloy as fastened metal. Do not use corrosive metals or incompatible materials on metal joints.
   2. Provide concealed fasteners for interconnection of sheet metal fabrications and for their attachment to other construction, unless otherwise accepted on shop drawings.

C. Backer Materials:
   1. Wood: 3/4" Marine Plywood
   2. Steel: Provide one of the following
      a. 16 ga Type 304 Stainless steel channels with sound deadening material.
      b. Galvanized steel hat channels with sound deadening material.
   3. Sound deadening material: Non –absorbent, hard drying sound deadening compound for permanent adhesion to metal that does not chip, flake, or blister in 1/8" thickness Aquaplas F-120A, gray, or approved equivalent.

D. Welding electrodes and filler metal:
   1. Type and alloy of filler metal and electrodes recommended by producer of metal to be welded, complying with applicable AWS specifications, and as required for strength and compatibility in the fabricated items.
   2. All welding shall conform to national and state requirements and related Specifications, and be performed by certified technicians. Exposed welds shall be continuous, filed or ground smooth and flush, and polished to match adjacent surfaces. Use methods that minimize distortion and develop strength and corrosion resistance base metal.
   3. Welds shall be free from gas holes, pits, cracks, dis-colorization and other imperfections.
   4. Provide full penetration welds for full-joint length. Welded joints shall be butt fitted, properly jigged, flat continuous, ground smooth and polished for exposed conditions.
   5. Where soldering is desirable, it shall be made with tin-lead solder. In no case shall soldering be relied upon for the stability of the seam or joint. Soldering shall serve only as a filler to prevent leakage, and shall not be considered as a replacement for welding or brazing.
   6. Butt joints made by spot welding or riveting straps under seams and filling with Solder, puddle welds and exposed screws are not acceptable.
   7. Exposed dimples from welding studs on underside of tops other surfaces is not acceptable. Polish surface to match and blend with adjacent surfaces.
   8. Welds on galvanized steel shall be smooth and strong. Remove all slag and carbonization. Where galvanizing has been burned off, touch up on both sides with high grade aluminum paint.
   9. Use filler metals and welding procedures which will blend with and match the color of sheet metal being joined and will prevent discoloration at welds.

E. Miscellaneous materials: As specified and as necessary to complete this work.

2.3 FABRICATION

A. Comply with AWS D-1.1 "Code for Welding in Building Construction", except as modified by the Drawings and Specifications.

B. Fabricate cabinets and countertops to comply with requirements indicated for design, dimensions, materials, joinery and performance.

C. Coordinate dimensions and attachment methods with those of adjoining construction to produce integrated assemblies with closely fitting, flush joints, and edges and surfaces aligned with one another in relationship indicated.

D. Increase metal thickness or reinforce metal with concealed stiffeners or backing materials, or both, as required to produce surfaces whose variations in flatness do not exceed those permitted by referenced standards for stretcher-leveled metal sheet and to impart sufficient strength for intended use.

E. Preassemble cabinets and countertops in the shop to the greatest extent possible to minimize field splicing and assembly. Use stainless steel fasteners and corner stiffeners. Disassemble only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.

F. Form to minimize joints and without exposed cut edges.
   1. Fold back exposed ends of unsupported sheet metal to form a ½-inch wide hem on the concealed side, or ease exposed edges with backing to a radius of approximately 1/16-inch.
   2. Produce flat, flush surfaces without cracking and grain separation at bends.

G. Continuously weld joints and seams, except where other methods of joining are indicated or accepted on shop drawings. Grind, fill and dress welds to produce smooth flush exposed surfaces where welds are invisible after final finishing is completed.

H. Provide holes of proper sizes and in correct locations required for attachment of work of other trades.
   1. Cut, tap, and drill as required, including for attachment of work under other Sections.
   2. Finishes free of kinks, twist, burrs and open joints. Damaged or distorted materials will not be allowed.

I. Install supporting members, fastenings, frames, hangers, bracing, brackets, straps, bolts and angles required to set and connect work to other construction.

J. Drill holes for bolts and screws; countersink holes for exposed screws. Provide rebates, lugs and brackets as required by details.

2.4 FINISHING

A. Provide right, directional polish: NAAMM No. 4 finish or No. 6 Hairline/Matt finish.

B. When polishing is completed, remove embedded foreign matter and leave surfaces chemically clean.

PART III – EXECUTION

3.1 EXAMINATION

A. Examine adjacent construction and supports.

B. Verify condition of stainless steel cabinets and countertops. Do not install stainless steel cabinets and countertops with scratches, stains and other defects that may be visible in the finished work.

C. Correct conditions detrimental to the proper and timely completion of this work before proceeding with installation.

3.2 INSTALLATION

A. Install stainless steel cabinets and countertops plumb and level, with tight hairline flush joints. Shim as required using concealed shims.

B. Scribe and fit accurately against adjacent surfaces for a close fit.

C. Attach securely to steel supports with concealed screws as required for a rigid and secure installation.

D. Seal interface of countertops with contiguous surfaces with sealant in compliance with the requirements of Section 07901. Tool sealant uniformly to form a cove and shed water.

3.3 CLEANING

A. After sealant has cured, clean stainless steel cabinets and countertops with manufacturer's recommended cleaning material in compliance with manufacturer's cleaning instructions.

3.4 PROTECTION

A. Protect stainless steel cabinets and countertops in place during the construction period to prevent damage and stains. Remove protection when no longer needed.

B. Restore damaged areas to match adjacent areas as recommended by the manufacturer.

C. Remove and replace materials that are damaged, scratched, have been stained, that do not match adjacent cabinets and countertops or cannot be satisfactorily cleaned or repaired, as determined and directed by the Architect or Owner's Representative.

D. Seal interface of countertops with contiguous surfaces with sealant in compliance with the requirements of Section 07901. Tool sealant uniformly to form a cove and shed water.

END OF SECTION

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. Framing with dimension lumber.
2. Rooftop equipment bases and support curbs.
3. Wood furring, grounds, nailers, and blocking.
4. Sheathing.

1.3 DEFINITIONS

A. Rough Carpentry: Carpentry work not specified in other Sections and not exposed, unless otherwise specified.

1.4 SUBMITTALS

A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.

B. Product Data for the following products:

1. Underlayment.
2. Insulating sheathing.
3. Air-infiltration barriers.
4. Joists or framing members.
4. Metal framing anchors.
5. Construction adhesives.

C. Material certificates for dimension lumber specified to comply with minimum allowable unit stresses. Indicate species and grade selected for each use and design values approved by the American Lumber Standards Committee's (ALSC) Board of Review.

D. Wood treatment data as follows, including chemical treatment manufacturer's instructions for handling, storing, installing, and finishing treated materials:

1. For each type of preservative-treated wood product, include certification by treating plant stating type of preservative solution and pressure process used, net amount of preservative retained, and compliance with applicable standards.
2. For waterborne-treated products, include statement that moisture content of

treated materials was reduced to levels indicated before shipment to Project site.

3. For fire-retardant-treated wood products, include certification by treating plant that treated materials comply with specified standard and other requirements as well as data relative to bending strength, stiffness, and fastener-holding capacities of treated materials.

E. Material test reports from a qualified independent testing agency indicating and interpreting test results relative to compliance of fire-retardant-treated wood products with requirements indicated. Submittal of reports to comply with Division 1 sections.

F. Warranty of chemical treatment manufacturer for each type of treatment.

G. Research or evaluation reports of the model code organization acceptable to authorities having jurisdiction that evidence the following products' compliance with building code in effect for Project.

1. Engineered wood products.
2. Foam-plastic sheathing.
3. Air-infiltration barriers.
4. Metal framing anchors.
5. Power-driven fasteners.
6. Fire-retardant-treated wood.

1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: To qualify for approval, an independent testing agency must demonstrate to Architect's satisfaction, based on evaluation of agency-submitted criteria conforming to ASTM E 699, that it has the experience and capability to satisfactorily conduct the testing indicated without delaying the Work.

B. Single-Source Responsibility for Engineered Wood Products: Obtain each type of engineered wood product from one source and by a single manufacturer.

C. Single-Source Responsibility for Fire-Retardant-Treated Wood: Obtain each type of fire-retardant-treated wood product from one source and by a single producer.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Keep materials under cover, dry and elevated above surface on which they are stored. Protect from weather and contact with damp or wet surfaces. Stack lumber, plywood, and other panels. Provide for air circulation within and around stacks and under temporary coverings.

1. For lumber and plywood pressure treated with waterborne chemicals, place spacers between each bundle to provide air circulation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers Compliance: Manufacturers used for this project shall comply with provisions of the American Recovery and Reinvestment Act of 2009.

B. 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:

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

1. Wood-Preservative-Treated Materials:

    a. Baxter: J. H. Baxter Co.
    b. Chemical Specialties, Inc.
    c. Continental Wood Preservers, Inc.
    d. Hickson Corp.
    e. Hoover Treated Wood Products, Inc.
    f. Osmose Wood Preserving, Inc.
    g. Or approved equal

2. Fire-Retardant-Treated Materials, Exterior Type:

    a. American Wood Treaters, Inc.
    b. Hoover Treated Wood Products, Inc.
    c. Trus Joist MacMillan.
    d. Or approved equal.

3. Gypsum Sheathing Board:

    a. Domtar Gypsum.
    b. Georgia-Pacific Corp.
    c. National Gypsum Co.; Gold Bond Building Products Division.
    d. United States Gypsum Co.
    e. Or approved equal

4. Extruded Cellular Polystyrene Sheathing:

    a. Amoco Foam Products Co.
    b. Dow Chemical Company (The).
    c. UC Industries, Inc.
    d. Or approved equal

5. Polyisocyanurate Foam Sheathing:

    a. Celotex Corporation (The); Building Products Division.
    b. NRG Barriers, Inc.
    c. Rmax, Inc.
    d. Or approved equal.

6. Air-Infiltration Barriers:

    a. Amoco Foam Products Co.
    b. Anthony Industries, Inc.; Simplex Products Division.
    c. Celotex Corporation (The); Building Products Division.
    d. DuPont Company; Fibers Department.
    e. Parsec, Inc.
    f. Raven Industries, Inc.
    g. Reemay, Inc.
    h. Sto-Cote Products, Inc.
    i. Or approved equal

7. Metal Framing Anchors:

    a. Cleveland Steel Specialty Co.
    b. Harlen Metal Products, Inc.
    c. Silver Metal Products, Inc.
    d. Simpson Strong-Tie Company, Inc.
    e. Southeastern Metals Manufacturing Co., Inc.
    f. Or approved equal

2.2 LUMBER, GENERAL

A. Lumber Standards: Comply with DOC PS 20, "American Softwood Lumber Standard," and with applicable grading rules of inspection agencies certified by ALSC's (American Lumber Standards Committee) Board of Review.

B. Inspection Agencies: Inspection agencies, and the abbreviations used to reference them, include the following:

1. NELMA - Northeastern Lumber Manufacturers Association.
2. NLGA - National Lumber Grades Authority (Canadian).
3. SPIB - Southern Pine Inspection Bureau.
4. WCLIB - West Coast Lumber Inspection Bureau.
5. WWPA - Western Wood Products Association.

C. Grade Stamps: Provide lumber with each piece factory marked with grade stamp of inspection agency evidencing compliance with grading rule requirements and identifying grading agency, grade, species, moisture content at time of surfacing, and mill.

1. For exposed lumber, furnish pieces with grade stamps applied to ends or

back of each piece, or omit grade stamps and provide grade-compliance certificates issued by inspection agency.

D. 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.

1. Provide dressed lumber, S4S, unless otherwise indicated.
2. Provide dry lumber with 19 percent maximum moisture content at time of dressing for 2-inch nominal (38-mm actual) thickness or less, unless otherwise indicated.

3. Provide lumber with 15 percent maximum moisture content at time of dressing for 2-inch nominal (38-mm actual) thickness or less, unless otherwise indicated.

2.3 WOOD-PRESERVATIVE-TREATED MATERIALS

A. General: Where lumber or plywood is indicated as preservative treated or is specified to be treated, comply with applicable requirements of AWPA C2 (lumber) and AWPA C9 (plywood). Mark each treated item with the Quality Mark Requirements of an inspection agency approved by ALSC's Board of Review.

1. Do not use chemicals containing chromium or arsenic.
2. For exposed items indicated to receive stained finish, use chemical formulations that do not bleed through, contain colorants, or otherwise adversely affect finishes.

B. Pressure treat aboveground items with waterborne preservatives to a minimum retention of 0.25 lb/cu. ft. (4.0 kg/cu. m). After treatment, kiln-dry lumber and plywood to a maximum moisture content of 19 and 15 percent, respectively. Treat indicated items and the following:

1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
2. Wood sills, sleepers, blocking, furring, stripping, and similar concealed members in contact with masonry or concrete.
3. Wood framing members less than 18 inches (460 mm) above grade.
4. Wood floor plates installed over concrete slabs directly in contact with earth.

C. Pressure treat wood members in contact with ground or freshwater with waterborne preservatives to a minimum retention of 0.40 lb/cu. ft. (6.4 kg/cu. m).

D. Complete fabrication of treated items before treatment, where possible. If cut after treatment, apply field treatment complying with AWPA M4 to cut surfaces. Inspect each piece of lumber or plywood after drying and discard damaged or defective pieces.

2.4 FIRE-RETARDANT-TREATED MATERIALS

A. General: Where fire-retardant-treated wood is indicated, comply with applicable requirements of AWPA C20 (lumber) and AWPA C27 (plywood). Identify fire-retardant-treated wood with appropriate classification marking of UL; U.S. Testing; Timber Products Inspection, Inc.; or another testing and inspecting agency acceptable to authorities having jurisdiction.

1. Research or Evaluation Reports: Provide fire-retardant-treated wood acceptable to authorities having jurisdiction and for which a current model code research or evaluation report exists that evidences compliance of fire-retardant-treated wood for application indicated.
2. For exposed items indicated to receive stained finish, use chemical formulations that do not bleed through, contain colorants, or otherwise adversely affect finishes.

B. Interior Type A: For interior locations, use chemical formulation that produces treated lumber and plywood with the following properties under conditions present after installation:

1. Bending strength, stiffness, and fastener-holding capacities are not reduced below values published by manufacturer of chemical formulation under elevated temperature and humidity conditions simulating installed conditions when tested by a qualified independent testing agency.
2. No form of degradation occurs due to acid hydrolysis or other causes related to treatment.
3. Contact with treated wood does not promote corrosion of metal fasteners.

C. Exterior Type: Use for exterior locations and where required by code.

D. Inspect each piece of treated lumber or plywood after drying and discard damaged or defective pieces.

2.5 MISCELLANEOUS LUMBER

A. General: Provide lumber for support or attachment of other construction, including rooftop equipment curbs and support bases, cant strips, bucks, nailers, blocking, furring, grounds, stripping, and similar members.

B. Fabricate miscellaneous lumber from dimension lumber of sizes indicated and into shapes shown.

C. Moisture Content: 19 percent maximum for lumber items not specified to receive wood preservative treatment.

D. Grade: For dimension lumber sizes, provide No. 3 or Standard grade lumber per ALSC's NGRs (non-grain-raising) of any species. For board-size lumber, provide No. 3 Common grade per NELMA, NLGA, or WWPA; No. 2 grade per SPIB; or Standard grade per NLGA, WCLIB or WWPA of any species.

2.6 CONCEALED, PERFORMANCE-RATED STRUCTURAL-USE PANELS

A. General: Where structural-use panels are indicated for the following concealed types of applications, provide APA-performance-rated panels complying with requirements designated under each application for grade, span rating, exposure durability classification, and edge detail (where applicable).

1. Thickness: Provide panels meeting requirements specified but not less than thickness indicated.
2. Span Ratings: Provide panels with span ratings required to meet "Code Plus" provisions of APA Form No. E30, "APA Design/Construction Guide: Residential & Commercial."

B. Roof Sheathing: APA-rated sheathing.

2.7 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, or in area of high relative humidity, provide fasteners with a hot-dip zinc coating per ASTM A 153 (2009) or of Type 304 stainless steel.

B. Nails, Wire, Brads, and Staples: FS FF-N-105.

C. Power-Driven Fasteners: CABO NER-272.

D. Wood Screws: ASME B18.6.1.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Discard units of material with defects that impair quality of rough carpentry and that are too small to use with minimum number of joints or optimum joint arrangement.

B. Set rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted.

C. Fit rough carpentry to other construction; scribe and cope as required for accurate fit. Correlate location of furring, nailers, blocking, grounds, and similar supports to allow attachment of other construction.

D. Apply field treatment complying with AWPA M4 to cut surfaces of preservative-treated lumber and plywood.

E. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:

1. CABO NER-272 for power-driven staples, P-nails, and allied fasteners.
2. Published requirements of metal framing anchor manufacturer.
3. "Recommended Nailing Schedule" of referenced framing standard and with AF&PA's "National Design Specifications for Wood Construction."
4. "Table 2304.9.1--Fastening Schedule," of the International Building Code.

F. Use common wire nails, unless otherwise indicated. Use finishing nails for finish work. 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; predrill as required.

G. Use hot-dip galvanized or stainless-steel nails where rough carpentry is exposed to weather, in ground contact, or in area of high relative humidity.

H. Countersink nail heads on exposed carpentry work and fill holes with wood filler.

3.2 WOOD GROUNDS, NAILERS, BLOCKING, AND SLEEPERS

A. Install wood grounds, nailers, blocking, and sleepers where shown and where required for screeding or attaching other work. Form to shapes shown and cut as required for true line and level of attached work. Coordinate locations with other work involved.

B. Attach to substrates to support applied loading. Recess bolts and nuts flush with surfaces, unless otherwise indicated. Build into masonry during installation of masonry work. Where possible, anchor to formwork before concrete placement.

C. Install permanent grounds of dressed, 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.

3.3 WOOD FURRING

A. Install plumb and level with closure strips at edges and openings. Shim with wood as required for tolerance of finish work.

1. Firestop furred spaces of walls at each floor level and at ceiling with wood blocking or noncombustible materials, accurately fitted to close furred spaces.

B. Furring to Receive Plywood Paneling: Install 1-by-3-inch nominal- (19-by-63-mm actual-) size furring at 24 inches (610 mm) o.c., horizontally and vertically. Select furring with no knots capable of producing bent-over nails and damage to paneling.

C. Furring to Receive Plywood Paneling: Install 19-by-63-mm actual-size furring at 600 mm o.c., horizontally and vertically. Select furring with no knots capable of producing bent-over nails and damage to paneling.

3.4 WOOD FRAMING, GENERAL

A. Framing Standard: Comply with AF&PA's "Manual for Wood Frame Construction," unless otherwise indicated.

B. Framing with Engineered Wood Products: Install engineered wood products to comply with manufacturer's written instructions.

C. Install framing members of size and at spacing indicated.

D. Do not splice structural members between supports.

E. Firestop concealed spaces of wood-framed walls and partitions at each floor level and at ceiling line of top story. Where firestopping is not inherent in framing system used, provide closely fitted wood blocks of 2-inch nominal- (38-mm actual-) thickness lumber of same width as framing members.

3.5 INSTALLATION OF STRUCTURAL-USE PANELS

A. General: Comply with applicable recommendations contained in APA Form No. E30, "APA Design/Construction Guide: Residential & Commercial," for types of structural-use panels and applications indicated.

1. Comply with "Code Plus" provisions of above-referenced guide.

B. Fastening Methods: Fasten panels as indicated below:

1. Combination Subflooring-Underlayment: Glue and nail to framing throughout.
2. Sheathing: Nail to framing.
3. Underlayment: Nail to subflooring.
4. Plywood Backing Panels: Nail or screw to supports.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.

1.2 DESCRIPTION OF WORK

A. Definition: finish carpentry includes carpentry work which is exposed to view, is non-structural, and which is not specified as part of Architectural Woodwork.

B. Architectural woodwork is specified in another Division 6 section.

1.3 QUALITY ASSURANCE

A. Factory mark each piece of lumber and plywood with type, grade, mill and grading agency identification, except omit marking form surfaces to receive transparent finish, and submit mill certificate that material has been inspected and graded in accordance with requirements if it cannot be marked on a concealed surface.

1.4 SUBMITTALS

A. Samples: Submit samples for each species and cut or pattern of finish carpentry.

B. Wood Treatment Data: Submit chemical treatment manufacturer's instructions for handling, storage, installation and finishing treated materials.

1.5 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Protect finish carpentry materials during transit, delivery, storage and handling to prevent damage, soiling and deterioration.

B. Do not deliver finish carpentry materials, 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, finish carpentry materials must be stored in other than installation areas, store only in areas meeting requirements specified for installation areas.

1.6 JOB CONDITIONS

A. Maintain temperature and humidity in installation area required to maintain moisture content of installed finish carpentry with a 1.0% tolerance of optimum moisture content, from date of installation through remainder of construction period. The fabricator of woodwork shall determine optimum moisture content and require temperature and humidity conditions.

PART 2 - PRODUCTS

2.1 WOOD PRODUCT QUALITY STANDARDS

A. Softwood Lumber Standards: Comply with PS 20 and with applicable grading rules of the respective grading and inspecting agency for the species and product indicated.

B. Plywood Standard: Comply with PS 1/ANSI A199.1.

C. Hardwood Lumber Standard: Comply with National Hardwood Lumber Association (NHLA) rules.

D. Hardwood Plywood Standard: Comply with PS 51.

E. Woodworking Standard: Where indicated for a specific product comply with specified provision of the following:
1. Architectural Woodwork Institute (AWI) "Quality Standards".

2.2 MATERIALS

A. General: Nominal sizes are indicated, except as shown by detailed dimensions. Provide dressed or worked and dressed lumber, as applicable, manufactured to the actual sizes as required by PS 20 or to actual sizes and patterns as shown, unless otherwise indicated.

B. Moisture Content of Softwood Lumber: Provide seasoned (KD) lumber having a moisture content from time of manufacture until time of installation not greater than values required by the applicable grading rules of the respective grading and inspecting agency for the species and product indicated.

C. Moisture Content of Hardwood Lumber: Provide kiln-dried (KD) lumber having a moisture content form time of manufacture until time of installation within the ranges required in the referenced woodworking standard.

D. Lumber for Transparent Finish (Stained or Clear): Use pieces made of solid lumber stock.

E. Lumber for Painted Finish: Use pieces of lumber made of solid lumber stock.

2.3 INTERIOR FINISH CARPENTRY

A. WM/Series Wood Molding Patterns: For stock molding patterns graded under Wood Molding and Millwork Producer Industry WM 4, provide the following grade based on finish indicated and fabricated from any Western softwood species graded and inspected by WWPA.

B. Hardwood Plywood Stock Panels: Provide manufacturer's stock hardwood plywood panels complying with applicable requirements of PS 51 for species and grade of face veneers and backing, adhesive, construction, thickness, panel size, and finish.
2. Face Veneer Species: As selected.
3. Grade: Premium.
4. Backing Veneer Species: Any hardwood compatible with face species.
5. Construction: Veneer core.
6. No. of Plies: 7.
7. Thickness: 3/4.
8. Panel Size: As selected or shown.
9. Plywood Type (Water Resistant Capability): Type II (Interior).]
10. Face Pattern: Plain (no grooves) with veneer edge matched within each panel face to comply with type of match required by referenced product standard.

2.4 MISCELLANEOUS MATERIALS

A. Fasteners and Anchorages: Provide nails, screws and other anchoring devices of the type, size, material, and finish required for application indicated to provide secure attachment, concealed where possible, and complying with applicable Federal Specifications.

2.5 WOOD TREATMENT

A. Preservative Treatment (Trt-Wd): Following basic fabrication provide 3 minute dip treatment of

finish carpentry items indicated to receive preservative treatment in 5% solution of pentachlorophenol, with vehicle which will not interfere with finish application and will produce minimum effect upon appearance. Apply brush coat on surfaces cut after treatment.

B. Fire Retardant Treated Wood (FRTW): Where wood is indicated as "FRTW", provide materials complying with applicable standards for pressure impregnation with fire retardant chemicals and with following requirements.
   1. AWPA Standard for Lumber: AWPA C 20 except as otherwise indicated.
   2. AWPA Standard for Plywood: AWPA C 27 except as otherwise indicated.
   3. Surface Burning Characteristics: Provide materials with surface burning characteristics not exceeding those indicated below when tested in accordance with ASTM E 84 for not less than standard time period (10 minutes).
      a. Flame Spread: 25.
   4. For FRTW wood used in interior application not exposed to relative humidities in excess of 92% use treatment chemicals with reduced hygroscopicity which are non-corrosive to metal fasteners, are non-blooming and permit use of transparent oilbased finishes.
      a. Products: Subject to compliance with requirements, provide one of the following:
         1) "Dricon", Koppers Company, Inc.
         2) "Flameproof LHC", Osmose Wood Preserving Co. of America, Inc.
         3) "Protex", Hoover Universal Wood Preserving Division.
   5. Kiln-dry wood after treatment to a maximum moisture content of 15% for plywood, 19% for lumber.
   6. Inspect each piece of lumber and plywood or each unit of finish carpentry after drying; do not use twisted, warped, bowed or otherwise damaged or defective wood.

PART 3 - EXECUTION

3.1 PREPARATION

A. Condition wood materials to average prevailing humidity conditions in installation areas prior to installing.

B. Backprime lumber for painted finish exposed on the exterior or, where indicated, to moisture and high relative humidities on the interior. Comply with requirements of sections on painting within Division 9 for primers and their application.

3.2 INSTALLATION

A. Discard units of material which are unsound, warped, bowed, twisted, improperly treated, not adequately seasoned or too small to fabricate work with minimum of joints or optimum jointing arrangements, or which are of defective manufacturer with respect to surfaces, sizes or patterns.

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 countertops; and with 1/16" maximum offset in flush adjoining 1/8" maximum offsets in revealed adjoining surfaces.

C. Scribe and cut work to fit adjoining work, and refinish cut surfaces or repair damaged finish at cuts.

D. Anchor finish carpentry work to anchorage devices 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 nails for exposed nailing, countersunk and filled flush with finished surface, and matching final finish where transparent is indicated.

E. Hardwood Plywood Paneling: Where grain character or color variations are noticeable, select and arrange panels on each wall for best match of adjacent panels. Install with uniform tight joints between panels.
   1. Attach panels to supports with panel adhesive and temporary bracing or fasteners, plus nailing where covered by moldings (if any), in accordance with manufacturer's instructions for concealed fastener installation.

F. Prefinished Hardwood Paneling, Board Type: Install in accordance with manufacturer's instructions for concealed nailing. Arrange in random width pattern suggested by manufacturer, unless boards are of uniform width. Stagger end joints in random pattern for best visual effect (uniformly distributed on each wall). Install with uniform joints, with only tongued and grooved or end matched joints within each field of paneling.

G. Softwood Paneling System, Board Type: Install in accordance with manufacturer's instructions by method indicated below, or if not indicated, as recommended by manufacturer for substrate provided.

3.3 ADJUSTMENT, CLEANING, FINISHING AND PROTECTION

A. Repair damaged and defective finish carpentry work wherever possible to eliminate defects functionally and visually; where not possible to repair properly, replace woodwork. Adjust joinery for uniform appearance.

B. Clean finish carpentry work on exposed and semi-exposed surfaces. Touch-up shop applied finishes to restore damaged or soiled areas.

C. Refer to Division 9 sections for final finishing of installed finish carpentry work.

D. Protection: Installer of finish carpentry work shall advise Contractor of final protection and maintained conditions necessary to ensure that work will be without damage or deterioration at time of acceptance.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Cabinet Hardware and Accessories.

1.2 REFERENCES

A. The publications listed below form a part of this specification to the extent referenced. Publications are referenced within the text by the basic designation only.

B. American National Standards (ANSI):
1. ANSI A208.1 - Particleboard
2. ANSI A208.2 - Medium Density Fiberboard For Interior Use

C. American Woodworking Institute (AWI): AWI – Architectural Woodwork Quality Standards.

D. American Plywood Association (APA): APA - Grades & Specifications.

E. National Electrical Manufacturer's Association (NEMA)
1. NEMA LD3 - High-Pressure Decorative Laminates

1.3 DELIVERY, STORAGE AND HANDLING

A. Inspect materials delivered and reject those not qualifying with requirements, those damaged in transit, or those that appear otherwise unsatisfactory.

B. Schedule delivery of items to installation areas that are in proper condition to receive them. Place items neatly and systematically to avoid damage, store in clean, dry, enclosed, and secure storage area.

PART 2 - PRODUCTS

2.1 CABINET HARDWARE AND ACCESSORIES

A. Provide cabinet hardware as specified by the following manufacturers:
1. Knape & Vogt (KV), 2700 Oak Industrial Drive NE, Grand Rapids, MI 49505, (616) 459-3311.
2. Hafele, 3901 Cheyenne Drive, Archdale, NC 27263, (800) 423-3531.
3. Ives, 2720 Tobey Drive, Indianapolis, IN 46219, (877) 613-8766.
4. Rockford Process Control, Inc., 2020 Seventh Street, Rockford, IL 61104, (815) 966-2000.
5. Blum, Inc., 7733 Old Plank Road, Stanley, NC 28164, (800) 438-6788.
6. Grass, 1202 Highway 66 South, Kernersville, NC 27284, (336) 423-5226.

B. Cabinet Hardware:
1. Wire Drawer and Door Pulls: ANSI/BHMA A156.9, B02011, solid metal, 4 inches long, 5/16 inch in diameter.
2. Drawer Slides: ANSI/BHMA A156.9, B05091. Slides shall include an integral positive stop to avoid accidental drawer removal.

a. Box Drawer Slides: Grade 1HD-100; side mounted; full-extension type; zinc-plated steel ball-bearing slides for drawers not more than 6 inches high and 24 inches wide.
b. File Drawer Slides: Grade 1HD-100; side mounted; full-extension type; zinc-plated steel ball-bearing slides for drawers more than 6 inches high or 24 inches wide.
c. Pencil Drawer Slides: Grade 1; side mounted; full-extension type; zinc-plated steel or epoxy-coated steel with polymer rollers for drawers not more than 3 inches high and 24 inches wide.

3. Drawer Locks: ANSI/BHMA A156.11, E07041.
4. Shelf Rests: ANSI/BHMA A156.9, B04013; metal.
   a. Place rests in drilled 5mm diameter holes, spaced vertically at 1 1/4" centers. Minimum of four rests per shelf.
   b. Shelf span per AWI/AWMAC/WI standards.
5. Door Locks: ANSI/BHMA A156.11, E07121.
6. Frameless Concealed Hinges (European Type): ANSI/BHMA A156.9, B01602, 100 degrees of opening, self-closing.

C. Cabinet Accessories: Provide cabinet accessories by the manufacturers specified below or equivalent products of same function, style, material, and finish from manufacturers specified above.
1. Grommets:
   a. Doug Mockett & Company: EDP-3 Round Plastic Grommets, removable caps with flip-down tabs. LO-2 Oval.
      1) Size as noted on Drawings.
      2) Color as noted on Drawings.
   b. Hardware Concepts: 6249.
      1) Size as noted on Drawings.
      2) Color as noted on Drawings.
   c. Bainbridge Manufacturing: 2 1/2 inch Round 1031BK-52.
2. Adjustable Shelf Pin: Hafele #282.40.708 5mm.

D. Exposed Hardware Finishes: For exposed hardware, provide finish that complies with ANSI/BHMA A156.18 for BHMA finish number indicated, except where indicated otherwise.
1. Satin Chromium Plated: BHMA 626 for brass base; BHMA 652 for steel base; BHMA 682 for zinc base.

E. For concealed hardware, provide manufacturer's standard finish that complies with product class requirements in ANSI/BHMA A156.9.

PART 3 - EXECUTION

3.1 CASEWORK

A. Install woodwork plumb, level, and straight without distortion; use concealed shims. Scribe and cut woodwork to fit adjoining work. Anchor woodwork items to nailers or blocking or directly to substrate using concealed fasteners.

B. Casework: Provide well-fitting and smooth operating doors and drawers.

C. Countertops: Anchor countertops securely to base units.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY:

A. Work of this sect on includes:
   1. Lavatory (Restroom sink) tops with integral sinks.

1.2 REFERENCES:

A. Applicable standards: Standards of the following, as referenced herein~
   1. American National Standards Institute (ANSI)
   2. ASTM International (ASTM)

1.3 SUBMITTALS:

A. Shop drawings: Indicate dimensions, component sizes, fabrication details attachment provisions and coordination requirements with adjacent work.

B. Samples: Submit minimum 6” by 6” samples. Indicate full range of color and pattern variation. Approved samples will be retained as a standard for work.

C. Product data: Indicate product description, fabrication information and compliance with specified performance requirement.

D. Maintenance data: Submit manufacturer’s care and maintenance data, including repair and cleaning instructions. Include in project closeout documents.

1.4 QUALITY ASSURANCE:

A. Job mock-up:
   1. Prior to final approval of shop drawings, erect at project site, for Architect’s review, one full size mock—up of each component required.
   2. Should mock~#up not be approved, re-fabricate and re-install until approval is secured. Remove rejected units from project site.
   3. Approved mock—ups may remain as part of finished work.

1.5 DELIVERY, STORAGE AND HANDLING:

A. Deliver no components to project site until areas are ready for installation. Store indoors.

B. Handle materials to prevent damage to finished surfaces. Provide protective coverings to prevent physical damage or staining following installation for duration of project.

1.6 WARRANTY:

A. Provide manufacturer’s warranty against defects in materials. Warranty shall provide for replacement material and labor for a period of ten years, beginning at Date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SOLID SURFACING MATERIAL:

A. Acceptable products:
   1. Basis of design: E. I. du Pont de Nemours & Co., Inc., Conan.
   2. Avonite, Inc., Formastone.
   3. Wilsonart International, Gibralter.

B. Material: Cast, 100% acrylic resin, solid, structural surfacing material.
   1. Material shall be through—patterned and homogeneous. No coated materials nor non—homogeneous materials allowed.
   2. Hardness: Minimum 55 Barcol hardness, tested in accord with ASTM D2583—95(2001), or minimum 90 Rockwell hardness, tested in accord with ASTM D785—98.
   3. Tensile strength: Minimum 4,200 psi, tested in accord with ASTM D638—0l.
   4. Abrasion resistance: Maximum 0.4 grams at 1,000 cycles, tested in accord with ASTM C501—84 (2002)
   5. Fire resistance: Flame spread and smoke developed meeting ASTM E84—04, Class I rating.
   6. Color stability: No change in 200 hours, tested in accord with NEMA LD3.
   7. Water absorption: Maximum 0.04% for 3/4”, 0.06% for 1/2”, 0.08% for 1/4”, tested in accord with ASTM D570—98.
   8. Fungal resistance: •No attack when tested in accord with ASTM G21—96(2002).
   9. Bacterial resistance: No attack when tested in accord with ASTM G22—76(1996).
   10. Impact resistance: No fracture when tested in accord with NEMA LD 3—3.3, 36” for 1/4”, 144” for 1/2”, 204” for 3/4”drop.
   11. Superficial damage to a depth of 0.10” shall be repairable by sanding and polishing.

2.2 CHARACTERISTICS:

A. Finish: Matte (Gloss rating of 5—20) -

B. Thicknesses:
   1. Lavatory (Restroom sink) tops: 3/4”, or as indicated on drawings.

C. Colors.: Colors as indicated on drawings or as selected by Architect from basis of design manufacturer’s Group E color range.

D. Lavatory tops with bowls:
   1. Provide configurations indicated.
   2. Provide backsplashes, end splashes and aprons as indicated.
   3. Bowls shall be integral with and same material and appearance as adjacent tops.
   4. Counters shall have removable front panel to allow access to water shut offs.

2.3 ACCESSORY PRODUCTS:

A. Joint adhesive: Manufacturer’s standard, two—part adhesive kit to create inconspicuous, nonporous joints, with a chemical bond.

B. Sealant: Manufacturer’s standard mildew—resistant, FDA/UL recognized silicone sealant in color matching surfacing or clear formulations.

C. Sink/bowl mounting hardware: Manufacturer's approved bowl clips, brass inserts and fasteners for attachment of undermount sinks/bowls.

2.4 FABRICATION:

A. Factory—fabricate components to greatest extent practicable, to sizes and shapes indicated, in accord with approved shop drawings.

B. Form joints between components using manufacturer's standard joint adhesive; without conspicuous joints and without voids. Attach a 2" wide reinforcing strip of solid surfacing under each joint.

C. Provide factory cutouts for plumbing fittings and bath accessories as indicated.

D. Rout and finish component edges to a smooth, uniform finish. Rout cutouts and sand edges smooth. Machine radii and contours to template. Repair or reject defective and inaccurate work.

E. Edge treatment for tops: As indicated on drawings.

F. Cold surfaces:
1. Make cutouts to template furnished by cold appliance manufacturer.
2. Reinforce joints and cutouts in accord with surfacing manufacturer's product data.
3. Provide installation between surfacing and adjacent cold appliances.
4. Thermally isolate hot and cold appliances.

G. Hot surfaces:
1. Provide expansion joints in countertops as indicated on shop drawings.
2. Make cutouts to template furnished by hot appliance manufacturer.
3. Reinforce joints and cutouts in accord with surfacing manufacturer's product data.
4. Provide insulation between surfacing and adjacent hot appliances.
5. Thermally isolate hot and cold appliances.
6. Provide venting of cabinets as indicated on drawings.

2.5 SOURCE QUALITY CONTROL:

A. Allowable tolerances:
1. Variation in component size: ±1/8".
2. Location of openings: ±1/8" from indicated location.

PART 3 - EXECUTION

3.1 INSTALLATION:

A. Install components plumb, level and rigid, scribed to adjacent finishes, in accord with approved shop drawings and product data.

B. Form field joints using specified adhesive, with joints inconspicuous in finished work.

C. Install top mount sinks/bowls to countertops using specified adhesives and color—matched silicone sealants.

D. Install under mount sinks/bowls to countertops per manufacturers written instructions.

E. Provide back and end splashes as indicated. Adhere to countertops using specified color—matched silicone adhesive.

F. Keep components clean during installation. Remove adhesives, sealants and other stains. Keep clean until Date of Substantial Completion. Replace stained components.

G. Make plumbing connections to sinks in accord with Mechanical Division of the Specifications.

3.2 PROTECTION:

A. Protect surfaces from damage until Date of Substantial Completion. Repair or replace damaged work which cannot be repaired.

END OF SECTION

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Special Conditions apply to this Section.

1.2 SUMMARY

A. This section includes:

B. Bituminous dampproofing.

1.3 REFERENCES

A. ASTM D 41 - Standard Specification for Asphalt Primer Used in Roofing, Dampproofing, and Waterproofing; 2005.

B. ASTM D 1227 - Standard Specification for Emulsified Asphalt Used as a Protective Coating or Roofing; 1995 (Reapproved 2000).

C. ASTM D 2822 - Standard Specification for Asphalt Roof Cement, Asbestos-Containing; 2005.

1.4 SUBMITTALS

A. Product Data: Provide properties of primer, bitumen, and mastics.

B. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.

1.5 ENVIRONMENTAL REQUIREMENTS

A. Maintain ambient temperatures above 40 degrees F (5 degrees C) for 24 hours before and during application until dampproofing has cured.

PART 2 PRODUCTS

2.0 COLD ASPHALTIC MATERIALS

A. Bitumen: Emulsified asphalt, ASTM D 1227; with fiber reinforcement other than asbestos

B. Asphalt Primer: ASTM D 41, compatible with substrate.(Type II).

C. Sealing Mastic: Asphalt roof cement, ASTM D 2822, Type I.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify substrate surfaces are durable, free of matter detrimental to adhesion or application of dampproofing system.

C. Verify items which penetrate surfaces to receive dampproofing are securely installed.

3.2 PREPARATION

A. Protect adjacent surfaces not designated to receive dampproofing.

B. Clean and prepare surfaces to receive dampproofing in accordance with manufacturer's instructions.

C. Do not apply dampproofing to surfaces unacceptable to manufacturer.

D. Apply mastic to seal penetrations, small cracks, or minor honeycomb in substrate.

3.3 APPLICATION

A. Prime surfaces, if required, in accordance with manufacturer's instructions.

B. Apply bitumen with mop.

C. Apply bitumen in one coat, continuous and uniform, at a rate per coat recommended by manufacturer.

D. Seal items projecting through dampproofing surface with mastic. Seal watertight.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Water repellent coating applied to non-painted exterior masonry surfaces.

B. Related Sections:
1. Section 04200 - Unit Masonry Assemblies: Substrate for application of water repellent.

1.2 SUBMITTALS

A. Certifications: Submit manufacturer's certification of conformance to specified surface preparation and application rates.

B. Test Results: Submit test results of initial and final RILEM test and final spray test.

C. Contract Closeout Submittals: Submit Letter of Certification under provisions of Section 01770.

1.3 QUALITY ASSURANCE

A. Qualifications:
1. Manufacturer: Company specializing in manufacturing Products specified with minimum 5 years documented experience.
2. Applicator: Company specializing in performing the work of this Section with minimum 5 years documented experience.

B. Regulatory Requirements: Comply with applicable rules and regulations of Pollution-Control Regulatory Agency having jurisdiction regarding volatile organic compounds (VOC) and use of hydrocarbon solvents.

C. Field Samples:
1. Prior to water repellent application, apply water repellent coating to field mock-up sample specified in Section 04200 for determination of coverage rate.
2. Apply water repellent at an initial rate of application as determined by the manufacturer as presumed necessary to pass the RILEM water tube uptake test results specified.
3. Allow five days for the sample to cure. Perform a RILEM water tube uptake test on the treated area conducted by or supervised by the manufacturer's representative. Place one tube on the block surface and one tube on a mortar joint.
4. Results: Absorption shall be not less than 1.0 milliliter of water using a RILEM water uptake tube at 60 mph wind driven rain equivalent. Apply additional repellent when tests results indicate failing results and retest until passing tests are achieved.
5. Coverage rate for entire project shall be that which is used to for the mock-up sample passing test.
6. Provide test report and application rates to the SOR.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Section 01600 - Materials and Equipment: Transport, handle, store, and protect products.

B. Protect coating liquid from freezing.

1.5 PROJECT CONDITIONS

A. Environmental Requirements: Do not apply Product during the following conditions:
1. Ambient temperature below 40 degrees F.
2. Substrate surfaces have cured less than 30 days.
3. Rain or temperatures below 40 degrees F are predicted for a period of 24 hours.
4. Surfaces not dry for minimum 24 hours.
5. Substrate frozen or surface temperature is below 40 degrees F.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with project requirements, manufacturer's offering Products which may be incorporated in the Work include the following:
1. BASF Building Systems, Shakopee, MN (800) 433-9517.
2. ChemRex: See BASF Building Systems.
3. Chemprobe Coating Systems, Garland, TX (800) 760-6776.
4. Evonik Degussa Corp., Parsippany, NJ (800) 828-0919.
5. L&M Construction Chemicals, Incorporated, Omaha, NE (800) 362-3331.
6. Modac Products Co., Broomall, PA (800) 626-0322.
7. ProSoCo, Incorporated, Kansas City, MO (800) 255-4255.
8. Rainguard International Products Company, Corona del Mar, CA, (949) 675-2811.

2.2 MATERIALS

A. Description: Clear penetrating water repellent. Siloxanes, silane or siloxane/silane blend, waterborne and VOC compliant.

B. Products:
1. Chemprobe: Prime-a-Pell H2O.
2. BASF (ChemRex): Enviroseal PBT.
3. Evonik Degussa: Protectosil Aqua-Trete Concentrate.
4. L&M: Hydroblock.
5. Modac: Siloxane 20.
6. ProSoCo: Weather Seal Siloxane WB Concentrate.
7. Rainguard: Blok-Lok.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine surfaces and adjacent areas where products will be applied and verify that surfaces conform to specifications and manufacturer's requirements for substrate conditions. Do not proceed until satisfactory conditions have been corrected.

B. Verify joint sealants are installed and cured.

C. Beginning of application indicates acceptance of substrate conditions.

3.2 PREPARATION

A. Surface cracks, holes, or other imperfections that exceed 1/64 of an inch shall be filled with pointing mortar. Masonry joints found to be unsound, hollow, or otherwise defective shall be raked out to a depth of 1/2 inch and pointed with mortar.

B. Remove loose particles and foreign matter. Remove oil or foreign substance with a cleaning agent which will not affect coating.

C. Scrub and rinse surfaces with water, and let dry.

D. Protect adjacent surfaces not scheduled to receive coating. If applied on unscheduled surfaces, remove immediately, by approved method.

E. Protect landscaping, property, and vehicles from over spray and drift.

3.3 APPLICATION

A. Apply after masonry mortar is cured for not less than seven days.

B. Apply coating in accordance with manufacturer's published instructions, using appropriate method and coverage rate.

3.4 FIELD QUALITY CONTROL

A. Manufacturer's Field Services: Provide services of a manufacturer-authorized technical service representative to inspect and approve the substrate before application, to instruct the applicator on the product and application method to be used, and to field test the in-place surfaces after application.

B. Spray Test: After water repellent has dried, spray coated surfaces with water. After surfaces have adequately dried, recoat surfaces that show water absorption.

C. Water Uptake Test: Perform a RILEM Water Uptake test on a minimum of 10 location on the completed project to confirm conformance to minimum results stated in Part 1 hereinbefore. Conduct test on upper and lower portions of the masonry surfaces and on an equal number of joints and block surfaces. Tests shall be conducted by the manufacturer’s representative.

D. Furnish written certification that surface preparation and rate of application is completed in accordance with specification requirements and the manufacturer’s recommendations. Furnish results of in-place RILEM and spray test.

3.5 CLEANING

A. Immediately clean water repellent from adjoining surfaces soiled or damaged by water repellent application as work progresses.

B. Repair damage caused by water repellent application.

C. Comply with manufacturer's published instructions for cleaning.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Rigid Foam Insulation
2. Spray Foam Insulation

B. Related Requirements:
1. Section 04200 - Unit Masonry Assemblies: Masonry fill insulation.
2. Section 07840 - Firestopping: Safing insulation used in conjunction with fire stop material.

1.2 REFERENCES

A. The publications listed below form a part of this specification to the extent referenced. Publications are referenced within the text by the basic designation only.

B. ASTM International (ASTM):
1. ASTM E 84 - Test Method for Surface Burning Characteristics of Building Materials.
2. ASTM C 578 - Rigid, Cellular Polystyrene Thermal Insulation.
3. ASTM C 665 - Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.
4. ASTM C 1289 - Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board.
5. ASTM E 136 - Behavior of Materials in a Vertical Tube furnace at 750 C.

1.3 DEFINITIONS

A. Concealed Insulation: Insulation concealed within framing system, both faces protected by finish material.

B. Exposed Insulation: Insulation exposed within framing system, one or both faces unprotected.

1.4 DELIVERY, STORAGE AND HANDLING

A. Transport, handle, store, and protect products in compliance with the requirements of Section 01600 and manufacturer's recommendations.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Provide products from one of the following manufacturers as specified in the Materials paragraph below:
1. Atlas Roofing Corp., Atlanta, GA (800) 933-1476.
2. CertainTeed Corporation, Valley Forge, PA (800) 523-7844.
3. Dow Chemical Company, Midland, MI (800) 232-2436.
4. Firestone Building Products Company, Carmel, IN (800) 428-4442.
5. Guardian Fiberglass Incorporated, Albion, MI (800) 748-0035.
6. Johns Manville Insulations, Denver, CO (877) 766-3295.
7. Owens-Corning, Toledo, OH (800) 438-7465.
8. Pactiv Building Products, Atlanta, GA (800) 241-4402.

2.2 REGULATORY REQUIREMENTS

A. Fire-Test-Response Characteristics: Provide insulation and related materials with the fire-test-response characteristics indicated, as determined by testing identical products per ASTM E 84 for surface-burning characteristics and other methods specified. Identify materials with appropriate markings of applicable testing and inspecting agency.

2.3 MATERIALS

A. Rigid Foam Insulation: Where indicated on the Drawings.
   1. Extruded Polystyrene:
      a) Thermal Resistance: minimum R-5 per inch
      b) Compressive Strength: Type X minimum 15 psi; Type IV minimum 25 psi
      c) Meeting the requirements of ASTM C578
      d) Provide one of the following or approved equivalent:
         1) Dow: Styrofoam Brand Cavitymate.
         2) Owens Corning: Foamular CW15/CW25.

B. Spray Foam Insulation: Closed Cell Spray Polyurethane Foam. Installed where indicated on the Drawings.
   1. Class I ASTM E 84 with maximum flame-spread and smoke-developed indexes of 20 and 450, respectively.
   2. A minimum 90% closed cell content.
   3. Thermal Resisitance: minimum R-6 per inch
   4. Provide spray foam insulation by one of the following manufacturers or approved equivalent:
      a) Airtight: Sprayfoam 2.0lb.
      b) Demilec: Heatloc 217-0.
      c) BASF: Comfort Foam.
      d) NCFI: Insulstar.
      e) BaySystems North America: Bayseal

C. Substitutions: Comply with the requirements of Section 01600.

2.4 ACCESSORIES

A. Tape: Polyethylene or polyester self-adhering type; two inches wide.

B. Adhesive: Waterproof type, acceptable to manufacturer of insulation board. Adhesive VOC shall be within the limits of not greater than 70 g/L in accordance with the California's South Coast Air Quality Management District (SCAQMD) Rule No. 1168.

PART 3 - EXECUTION

3.1 PREPARATION

A. Rigid Foam Insulation:
   1. Verify substrate and adjacent materials and insulation boards are dry and ready to receive insulation and adhesive.
   2. Verify insulation boards are unbroken, free of damage.

B. Spray Foam Insulation:
1. Verify surfaces to be sprayed with are dry, clean, and secure.
2. Remove sawdust and other debris from areas to be sprayed by blowing with compressed air or vacuuming with shop vacuum.
3. All metals to which foam is to be applied must be free of oil, grease, rust, etc.
4. Primers should be used if necessary.
5. Mask off all areas not to receive spray foam with masking tape and plastic sheeting

3.2 INSTALLATION - RIGID FOAM INSULATION

A. Apply insulation in accordance with manufactures recommended application procedures.

3.3 INSTALLATION - SPRAY FOAM INSULATION

A. Apply insulation in accordance with manufactures recommended application procedures.

3.4 INSTALLATION - INSULATION AT FURRED-OUT MASONRY WALLS

A. Apply insulation to interior of exterior CMU wall between furring strips where furring is indicated on Drawings.

3.5 SCHEDULES

A. Provide insulation types as scheduled below and as indicated on Drawings.

CONDITION	TYPE OF INSULATION	THICKNESS
Masonry Unit Cavity Walls	Rigid Foam Insulation	3 inches (R-15)
Roof	Rigid Foam Insulation	6 inches (R-30)

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Standing seam metal roofing (SSMR) and accessories.

B. Related Sections:
1. Section 6100 – Rough Carpentry. Plywood roof decking.

1.2 REFERENCES

A. The publications listed below form a part of this specification to the extent referenced. Publications are referenced within the text by the basic designation only.

B. American Architectural Manufacturers Association (AAMA):
1. AAMA 621 - Voluntary Specifications for High Performance Organic Coatings on Coil Coated Architectural Hot Dipped Galvanized (HDG) and Zinc-Aluminum Coated Steel Substrates.

C. ASTM International (ASTM):
1. ASTM A 755A - Steel Sheet, Metallic Coated by the Hot-Dip Process and Prepainted by the Coil-Coating Process for Exterior Exposed Building Products.
2. ASTM A 792A - Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process.
3. ASTM D 226 - Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing.
4. ASTM D 523 - Test Method for Specular Gloss.

1.3 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing Work of this Section with minimum 5 years documented experience certified by sheet metal roofing manufacturer as an "Approved Installer."

1.4 DELIVERY, STORAGE AND HANDLING

A. Section 01600 - Product Requirements: Deliver, handle, store, and protect products.

B. Stack preformed and prefinished material to prevent twisting, bending, or abrasion, and to provide ventilation. Comply with manufacturer's recommendations for job site storage, handling, and protection.

C. Prevent contact with materials during storage which may cause discoloration or staining.

D. Do not overload roof structure with stored materials. Do not permit material storage or traffic on completed roof surfaces.

1.5 WARRANTY

A. Provide manufacturer’s twenty year standard warranty against failure due to corrosion, rupture or perforation.

B. Provide manufacturer's standard warranty covering watertightness of the roofing system for the period of two years from the date of substantial completion.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Standing Seam Metal Roof Panel: 24 gage; Aluminum-Zinc Alloy-Coated Steel Sheet, ASTM A 792A, Class AZ50 coating designation, Grade 40, structural quality, UL90 rated panels, and prepainted by the coil-coating process to comply with ASTM A 755/A. Provide panels by one of the following:
1. Snap-Seam System Standing Seam Roof by AEP-SPAN, Dallas, TX (800) 527-2503.
2. Cee-Lock Snap-Lock Standing Seam Roof by Berridge Manufacturing Company, Houston, TX (800) 231-8127.
3. UC-14 Standing Seam Roof System by UNA-CLAD, Firestone Metal Products, Anoka, MN (800) 426-7737.
4. Lokseam Standing Seam Roof System by MBCI, (800) 206-6224.
5. Snap-Clad Standing Seam Roof System by PAC-CLAD, Petersen Aluminum Corporation, Elk Graove Village, IL (800) 722--2523.

B. Seam Spacing:
1. AEP-SPAN: 18 inches. (10", 12", and 24" available)
2. Berridge: 16-1/2 inches.
3. Firestone: 18 inches (10, 12, and 16" available)
4. MBCI: 18 inches (10" and 12" available)
5. PAC-CLAD: 18 inches (10", 12", and 16" available)

C. Finish: Smooth panel with factory finished baked-on flouropolymer 2-coat coating system.
1. Manufacturer's standard 2-Coat Fluoropolymer conforming to AAMA 621. Fluoropolymer finish containing not less than 70 percent Kynar 500 PVDF resin by weight in color coat with a minimum of 0.9 mil dry film thickness. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
2. Color: To be selected by Architect. Submit samples in accordance with section 01330.

2.2 ACCESSORIES

A. Provide manufacturer's standard accessories and other special items required for sheet metal roof system installation. Provide accessories with same finish and color as sheet metal roofing.
1. Trim Items: Same material and finish as roofing panels.
2. Fasteners: Recommended by roofing system manufacturer for intended purpose.
3. Mastic Tape: Manufacturer's standard.
4. Sealants: Color coordinated primerless silicone, or high grade, non-drying butyl recommended by panel manufacturer.

B. Underlayment:
1. Asphalt Saturated Fiberglass: ASTM D 226; Type II (No. 30) asphalt saturated fiberglass roofing felt, nonperforated.
2. Polyethylene/ Rubberized Asphalt: Polyethylene sheet with rubberized asphalt self-adhering underlayment. Grace Ice & Water Shield manufactured by W.R. Grace, Cambridge, MA.

C. Protective Backing Paint: Bituminous.

2.3 DECKING

A. Exterior plywood roof decking structural panels, thickness as shown, as specified in Section 06100.

B. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FMG 4470, designed for fastening substrate board to substrate.

2.4 INSULATION

A. Isocyanurate Foam Insulation: Polyisocyanurate board insulation, ASTM C 1289, Type II, felt or glass-fiber mat facer on both major surfaces, with an LTTR (Long Term Thermal Resistance) value of 17.2 based on ASTM C 1303.
   1. Subject to compliance with requirements, provide one of the following products:
      a. HPH by Carlisle.
      b. ISO 95+ GL, by Firestone.
      c. E'NRG'Y 3 or ISO 3 by Johns Manville.
      d. Products meeting the specified requirements by other manufacturers as recommended by the roofing membrane manufacturer.
   2. Thickness: 2.8 inches min
      a. HPH by Carlisle.
      b. ISO 95+ GL, by Firestone.
      c. E'NRG'Y 3 or ISO 3 by Johns Manville.
      d. Products meeting the specified requirements by other manufacturers as recommended by the roofing membrane manufacturer.

2.5 FABRICATION

A. Panels: Full length factory-formed panels, width as specified.

B. Seams: Interlock panel seams entire length of panel, while allowing expansion and contraction movement. Seam shall lock and resist joint disengagement during design wind uplift conditions. Field seam when recommended by manufacturer. Fabricate female leg with pressure equalized capillary break to prevent water siphoning through joints. Provide factory sealant on leading edge of female seam leg for panel-to-panel seal.

C. Clips: Provide UL listed clip designed to allow panels to thermally expand and contract.

D. Use concealed anchors that permit expansion and contraction. Exposed fasteners in panels not permitted.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine surfaces and adjacent areas where products will be installed and verify that surfaces conform to product manufacturer's requirements for substrate conditions. Do not proceed until unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Broom clean substrate deck surfaces immediately before starting installation.

3.3 INSTALLATION

A. Install sheet metal roofing and accessories in accordance with manufacturer's published instructions.

B. Dissimilar Metals: Back paint surfaces in contact with dissimilar materials.

C. Underlayment:
1. Asphalt Saturated Fiberglass: Apply beneath roof panels over unoccupied spaces. Install over substrate starting at lower point of roof surface, with horizontal overlaps and end laps staggered between layers. Lay parallel to ridge line with minimum 12 inch vertical laps and 6 inch horizontal laps. Install smooth and uniform. Secure in place.
2. Polyethylene/ Rubberized Asphalt: Apply below SSMR over occupied spaces. Install ice and water shield over entire deck beneath roof panels. Apply in accordance with manufacturer's recommendations.

D. Metal Roof System:
1. Install panels in accordance with manufacturer's published instructions and recommendations and as defined under this Section.
2. Anchor securely in place using clips and fasteners spaced in accordance with manufacturer's recommendations for design wind load criteria. Fasteners shall be of the length required to penetrate deck a minimum of 3/4 inch.
   a. Install to requirements for UL 90 uplift resistance.
3. Fully seat adjacent panel to achieve continuous engagement of standing seam joint.
4. Align panel seams at valley locations and ridge locations.

E. Apply sealant to penetrations, transitions, and other locations necessary (not standing seam) for airtight, waterproof installation.

3.4 FIELD QUALITY CONTROL

A. Inspect sheet metal roofing system installation for specified material, color, and attachment requirements. Inspect metal flashings, counter flashings and vents.

B. Correct deficiencies in Work which inspection indicates are not in compliance with Contract requirements.

3.5 CLEANING

A. Clean exposed surfaces of Work immediately after completion of installation.

B. Clean exposed surfaces of Work 24 hours prior to date of Substantial Completion.

3.6 PROTECTION

A. Provide protection and maintain manufacturer's recommended conditions to prevent damage of deterioration of sheet metal roofing system until date of Substantial Completion.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

A. Related Documents:
1. Drawings and general provisions of the Subcontract apply to this Section.
2. Review these documents for coordination with additional requirements and information that apply to work under this Section.

B. Section Includes:
1. Mechanically fastened polyvinyl chloride (PVC) thermoplastic membrane roofing.
2. Preparation of roof surfaces for application of roofing system.
3. Roof insulation.
4. Traffic pads.
5. Membrane flashing.
6. Coordination of items built into roofing system.

C. Related Sections:
1. Division 01 Section "General Requirements."
2. Division 07 Section "Sheet Metal Flashing and Trim".
3. Division 09 Section "Joint Sealants".
4. Division 15 "HVAC".
5. Division 16 "Electrical."

1.2 REFERENCES

A. General:
1. The following documents form part of the Specifications to the extent stated. Where differences exist between codes and standards, the one affording the greatest protection shall apply.
2. Unless otherwise noted, the referenced standard edition is the current one at the time of commencement of the Work.
3. Refer to Division 01 Section "General Requirements" for the list of applicable regulatory requirements.

B. ASTM International:
1. ASTM C1289 – Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board
2. ASTM D-751 - Standard Test Methods for Coated Fabrics
3. ASTM D-882 – Standard Test Method for Tensile Properties of Thin Plastic Sheeting
4. ASTM D-1240 – Standard Test Methods for Rosin Acids Content of Naval Stores, Including Rosin, Tall Oil, and Related Products
5. ASTM D-3045 – Standard Practice for Heat Aging of Plastics Without Load
6. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials
7. ASTM D-4434 – Standard Specification for Poly(Vinyl Chloride) Sheet Roofing

C. Factory Mutual Engineering and Research Corp. (FM):
1. FM P7825 - Approval Guide - Equipment, Materials, Services for Conservation of Property.
2. FM AS4470 - Approval Standard 4470 Class I Roof Covers.
3. FM D/51-28 - Insulated Steel Decks.
4. FM Class I-60.
5. FM Bulletin I-49 - Perimeter Flashings.

D. National Roofing Contractors Association (NRCA): Roofing and Waterproofing Manual.

E. Underwriters' Laboratories, Inc. (UL):
1. UL 790 - Tests for Fire Resistance of Roof Materials.

2. UL 1256 - Fire Test for Roof Deck Constructions.
3. UL BMD - Building Materials Directory.

1.3 DEFINITIONS

A. Roofing Terminology: Refer to ASTM D 1079 for definition of terms related to roofing work not otherwise defined in this Section.

1.4 SYSTEM DESCRIPTION

A. Provide a PVC thermoplastic membrane roofing and base flashing system that is watertight; will not permit the passage of liquid water; will withstand wind loads, thermally induced movement, and exposure to weather without failure.

B. Material Compatibility: Provide roofing materials that are compatible with one another under conditions of service and application required, as demonstrated by roofing system manufacturer based on testing and field experience.

C. Roofing System Design: Provide a PVC thermoplastic membrane roofing system that complies with roofing system manufacturer's written design instructions:

1.5 SUBMITTALS

A. Submit under provisions of Division 01 Section "General Requirements."

B. Product Data: For each type of roofing product specified, submit the following:
1. Written list of all materials for use in this project.
2. Manufacturer's literature, specifications, recommendations and installation instructions for roof membrane, base flashing, insulation, fasteners, and other materials required to provide a complete system.
   a. Include volatile organic compounds (VOCs) in grams/liter (g/l).
3. Identify in writing the differences between manufacturer's instructions and the requirements in this Section. Provide manufacturer's written approval of project modifications.
4. Manufacturer's literature, letter of certification, or certified laboratory test report stating that each material complies with the requirements of this Section and is intended for the application shown.
5. Manufacturer's written certificate of compliance for all products delivered to the job site that its products conform to applicable material standards, and the products are physically and chemically compatible with each other.
6. Material Safety Data Sheets (MSDS).
7. UL and FM approvals.

C. Shop Drawings: Plans, sections, and details of the following:
1. Base flashings and roof membrane terminations.
2. Layout of insulation board indicating thickness to achieve drainage slopes and crickets, and fastening system and pattern to meet uplift requirements.
3. Layouts for crickets and saddles
4. Walk pad layout
5. Details required for completion but not shown on Drawings
6. Roof breather vent locations.

D. Samples: Comply with the requirements of Section 01330
1. Roof membrane , including T-shaped side and end laps 12 by 12 inches (300 by 300 mm).
2. Roof insulation 12 by 12 inches (300 by 300 mm).
3. Walkway pad - 12 by 12 inches (300 by 300 mm) if roll, 1 unit if tile.
4. Termination and fascia bars – 12 inches (300 mm) length.

E. Installer Certificate: Signed by roofing system manufacturer certifying that installer is approved, authorized, or licensed by manufacturer to install specified roofing system.

F. Installer References: List of 5 completed projects of similar scope using the specified roofing system, with names and addresses of projects, architects and owners.

G. Warranty: Sample copy of roofing system manufacturer's standard warranty stating obligations, remedies, limitations, and exclusions of warranty.

H. Closeout Submittals:
1. Information Card: For each roofing installation, 2 - 8 1/2 by 11 inches cards, typewritten, laminated and framed, or photo engraved on 0.032 inches (8 mm) aluminum containing the information listed in Article below.
2. Product Usage Records: 3 copies of product usage records for each adhesive, sealant and solvent product used in the project. Include product name, amount used, and period of time over which the product was used.
3. Installer's Certification: Certification that work under this Section has been installed in accordance with these specifications.
4. Manufacturer's maintenance Instructions.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Installer specializing in installing roofing systems similar to specified system, and who is approved, authorized, or licensed by the roofing system manufacturer to install manufacturer's product.

B. Identify materials with appropriate markings of applicable testing and inspecting agency (UL, FM).

C. Pre-Installation Conference:
1. Convene Pre- installation Conference at Site a minimum of one week prior to commencing work of this section. Require attendance of parties directly affecting work of this Section including but not limited to the following:
   a. Owner Representative
   b. General Contractor
   c. Roofing subcontractor (Roofing Applicator and job foreman).
   d. Mechanical and Plumbing subcontractors
   e. Roofing manufacturer's technical representative
2. Notify attendees and Architect at least two weeks prior to the conference.
3. Conflicts among those attending the meeting shall be resolved and confirmed in writing before roofing work is begun.
4. Agenda:
   a. Review methods and procedures related to roofing work.
   b. Tour representative areas of roof decks, and inspect and discuss conditions of substrates, roof drains, curbs, penetrations and other preparatory work performed by other trades.
      1) Inspect deck substrates for appropriate slopes.
   c. Review structural loading limitations of roof deck.
   d. Review roofing system requirements of Subcontract Documents.
   e. Review approved submittals.
   f. Review and finalize roofing construction schedule.
      1) Verify availability of materials, equipment, and facilities needed to make progress and avoid delays.
   g. Review required inspection, testing, certifying and materials usage accounting procedures.
   h. Review weather and forecasted weather conditions, and procedures for coping with unfavorable conditions, including possibility of temporary roofing.
   i. Review Subcontractor's plan for coordination of work of various trades involved in providing roofing system and other components secured to roofing.
   j. Safety requirements:
      1) Installation, material handling, and associated equipment shall conform to and be operated in conformance with OSHA safety requirements.

2) Provide a sufficient number of filled and operating fire extinguishers meeting current code standards on the roof deck at all times during roofing operations.
3) Coordinate the work of other trades involved in the project for safe operations.

k. Enact provisions for monitoring the roof after completion.
l. Other details of the work the Subcontractor is to perform which are not shown on Drawings.

5. Record discussions of conference and decisions and agreements (or disagreements) reached, and furnish copy of record to each party attending and Architect.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Transport, handle, store and protect products in compliance with the requirements of Section 06100 and manufacturer's recommendations.

B. Deliver roofing materials to project site in original containers with seals unbroken and labeled with manufacturer's name, product brand and type, date of manufacture, and directions for storing and mixing with other components.
1. Identify materials with FM and UL markings.

C. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by the roofing system manufacturer.
1. Protect stored liquid materials from direct sunlight.
2. Discard and dispose of liquid material that cannot be applied within its stated shelf life.

D. Protect roof insulation materials from damage and from deterioration by sunlight, moisture, soiling, and other sources. Store in a dry location. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation.

E. Handle and store roofing materials, and place equipment, in a manner to avoid permanent deflection of roof deck. Do not store materials on completed roofing.

F. Store materials in a weather protected environment, clear of ground moisture. Storage requirements for insulation are as follows:
1. Cut or remove plastic shipping wrap from insulation.
2. Cover with tarpaulin, shield from moistures and ultraviolet rays.
3. Elevate minimum of 4 inches above substrate.
4. Secure to resist high winds.
5. Distribute insulation stored on roof deck to prevent concentrated loads.
6. Do not install wet insulation. Insulation shall be thoroughly dry prior to installation.

G. Store cements, primers, and caulks in heated area above 40 degress F during cold weather and in area below 80 degrees F in warm weather.

1.8 PROJECT CONDITIONS

A. Environmental Requirements: Proceed with roofing work only when existing and forecast weather conditions permit roofing to be installed according to manufacturer's written instructions and warranty requirements. Follow industry standards for environment requirements including but not limited to the followings:
1. Do not apply roofing membrane during inclement weather. When air temperature is expected to fall below 40 degrees F, follow specified Cold Weather Application Procedures as specified herein.
2. Do not apply finished roofing system to wet, damp or frozen deck surface or when precipitation is occurring.
3. Do not expose materials vulnerable to water or sun damage in quantities greater than can be weatherproofed during same day.

1.9 WARRANTY

A. Standard Roofing Manufacturer's Warranty: Submit a written warranty, without monetary limitation, signed by roofing system manufacturer, agreeing to promptly repair leaks resulting from defects in materials or workmanship for a period of not less than 15 years. Warranty shall include the following:
   1. Manufacturer shall pay all costs to replace or restore to its original condition all flat stock and tapered roof insulation that becomes moisture saturated due to leaks resulting from faulty materials or workmanship.
   2. Manufacturer shall pay all costs associated with replacement of rusted or otherwise defective "approved" fasteners.
   3. The warranty shall cover 100 percent replacement cost.
   4. There shall be no penal sum associated with this warranty.
   5. The University shall be able to make temporary repairs without voiding the warranty.
   6. Copies of the roof plan, details and specifications shall be attached to the warranty.
   7. There shall be no exclusions in the warranty for consequential damages.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Primary materials shall be the products of one manufacturer. Secondary materials shall be as required or recommended by primary materials manufacturer, and in accordance with these specifications.

B. Approved PVC Thermoplastic Membrane Roofing Manufacturers: Duro-Last, Bondcote, Fibertite, or equal.

C. Established Standard (basis of design): Products of Duro-Last Roofing, Inc. or equal products from approved manufacturers listed in Article 2.1.B above.

2.2 MATERIALS

A. Roof Membrane Sheet: Uniform flexible sheet formed from polyvinyl chloride with plasticizers and modifiers, complying with ASTM D4434, Type IV, of the following type, grade, thickness, and exposed face color.
   1. Thickness: 60 mils, nominal, 16 mils above reinforcement.
   2. Exposed Face Color: White, embossed texture
   3. Minimum Physical Properties:
      a. Breaking Strength: 275 lbs/in, ASTM D751, Procedure A.
      b. Elongation at Break: 25 percent, ASTM D751.
      c. Tearing Strength: 90 lbs/ft.
      d. Resistance to Heat Aging: 90 percent retention of breaking strength and elongation at break, ASTM D3045.
      e. Low-Temperature Bend: Pass at minus 40 degrees F, ASTM D2136.
      f. Accelerated Weathering Test: No cracking or crazing after 6000 hours, ASTM D4434.
      g. Linear Dimensional Change: 0.5 percent maximum after 6 hours at 176 degrees F, ASTM D1204.
      h. Water Absorption: Less than 3 percent mass change, ASTM D570.

B. Insulation:
   1. Polyisocyanurate Board: As recommended by roofing membrane manufacturer from products manufactured by Energy Solutions Insulation, Inc., ESI tapered insulation board; Firestone Inc., ISO 95+ tapered insulation board, or equal. Established standard ES – Foam I tapered board as manufactured by Energy Solutions Insulation, Inc., (877)285-7692, 831 Morley Drive, Saginaw, Michigan 48601.
      a. Thickness: as required to achieve R30 minimum.
   2. Preformed Tapered Roof Insulation: Boards complying with requirements, selected from manufacturer's standard sizes and thickness to achieve slopes indicated, minimum 1/2" thickness.
   3. Roof Curb Insulation: Polyisocyanurate Foam; both faces covered with glass fiber felt; thickness to match wood nailer.
   4. Insulation Accessories: Accessories as recommended by insulation manufacturer for intended use, and approved by roofing membrane manufacturer.

C. Accessories:
1. Provide accessories recommended by roofing system manufacturer for intended use and compatible with membrane roofing material, including but not limited to those shown on drawings and indicated below.
2. Furnish liquid-type auxiliary materials that meet VOC limits of authorities having jurisdiction.
3. Sheet Flashing: Manufacturer's standard sheet flashing of the same material, type, thickness, and color as roof membrane.
4. Slip-Sheet: Manufacturer's recommended slip-sheet of type required for application.
5. Termination Bars: Manufacturer's standard bars, approximately 1 to 1.5 inches wide, formed, and prepunched.
6. Fasteners: Factory-coated steel fasteners and metal or plastic plates meeting corrosion-resistance provision of FM4470, designed for fastening sheet to substrate, and acceptable to roofing system manufacturer and insulation manufacturer.
7. Miscellaneous Accessories: Provide pourable sealers, preformed pipe sheet flashings, preformed inside and outside corner sheet flashings, T-joint covers, seam caulk, termination reglets, breather vents, and other accessories recommended by roofing manufacturer for intended use. These accessories are to be covered by the roofing systems manufacturer's system warranty for the warranty period.
8. Pre-fabricated Piping Support Bases: Advanced Support Products, Inc, Key Curb Supports #KC6, KC9 or KC13; The Pate Company, #ES2; or approved equal; sizes and configurations indicated.
9. Underlayment Board: Manufacturer's recommended underlayment board required for the application.
10. Walkway Pads: Factory-formed, nonporous, heavy-duty, slip-resistant, surface-textured walkway pads, 1/8-inch thick, minimum, of materials acceptable to roofing system manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATON

A. Inspect the roof deck and verify that there are no conditions which may prevent or interfere with the installation of the roof and flashing system.

B. Report any adverse condition which may affect the performance of the roof system in writing to the Project Manager. Absence of such notification shall constitute Subcontractor's verification that existing conditions will allow the installation of the system in accordance with the Drawings, Specifications and manufacturer's warranty.

C. Ensure that the following conditions exist prior to application of roofing materials:
1. Drains, curbs, cants, area separators, perimeter walls, roof penetrating components, and equipment supports are in place.
2. Surfaces are rigid, dry, smooth, and free from cracks, holes, depressions, waves, sharp changes in elevation, and projections.
3. Concrete decks have been cured to roof membrane manufacturer's recommended moisture content, inspected and approved by the manufacturer's representative.
4. The substrate plane does not vary more than 1/8 inch (3 mm) within an area 10 by 10 (3 by 3 m) feet when checked with a 10-foot (3 m) straight edge placed anywhere on the substrate
5. Substrate is prepared to elevations indicated on the Drawings, and relationship of substrate to cast-in-place roof drains provides positive drainage as required.
6. Walls and vertical surfaces are constructed to receive base flashings and counter flashings.
7. Treated wood nailers are fastened in place at eaves, gable ends, openings, and intersections with vertical surfaces for securing of roof membranes and related components and roof fixtures. Nailers are the same thickness as the roof insulation, unless otherwise shown.

3.2 PREPARATION

A. Clean substrate of dust, debris, and other substances detrimental to roofing installation, in accordance with roofing system manufacturer's written instructions. Remove sharp projections.

B. Prevent materials from entering and clogging roof drains and over-flow drains, and migrating onto surfaces of other construction. Remove roof-drain plugs when no roof work is taking place or when rain is forecast.

C. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system at the end of each workday or when rain is forecast. Remove and discard temporary seals before beginning work on adjoining roofing.

D. Surface Preparation:
1. Prior to commencing roof installation, all roof substrates shall be clean and free of all debris.
2. Correct defects and inaccuracies in roof deck surface to eliminate poor drainage and hollow and low spots.
3. Concrete Surfaces: Fill honeycomb, pits and other variation with latex filler

E. Do not apply roofing materials unless proper temperature can be maintained.

F. Coordinate the work with other trades to assure that components which are to be secured to or built into the roofing system are available and that flashing and counter flashing are installed as the work progresses.

3.3 INSULATION INSTALLATION

A. Coordinate installing roofing system components so insulation is not exposed to precipitation or left exposed at the end of the day.

B. Comply with roofing system manufacturer's written instructions for installing roof insulation.

C. Mechanically fasten insulation boards in accordance with roofing system's and insulation manufacturer's instructions and approve Shop drawing fastening layout.

D. Trim surface of insulation where necessary at roof drains so completed surface is flush and does not restrict flow of water.

E. Install insulation with long joints of insulation in a continuous straight line with end joints staggered between rows, abutting edges and ends between boards. Fill gaps exceeding ¼-inch with same insulation.

F. Cut and fit insulation within ¼-inch of nailers, projections, and penetrations.

G. Conform layout, crickets and drainage slopes to approved shop drawings.

3.4 MECHANICALLY FASTENED SHEET INSTALLATION

A. Install roof membrane over area to receive roofing according to roofing system manufacturer's written instructions, and [standard] installation details. Unroll sheet and allow to relax for a minimum 30 minutes.
1. Install sheet according to ASTM D5082.

B. Start installation in the presence of roofing system manufacturer's technical representative.

C. Accurately align sheets and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps.

D. Mechanically fasten sheet securely at terminations and perimeter of roofing.

E. Apply roofing sheet with side laps shingled with slope of roof deck where possible.

F. Spread sealant bed over deck drain flange at deck drains and securely seal roofing sheet in place with clamping ring. Back putty the inside of adjustable roof drain collar with drain hub with roof cement to watertight condition.

G. In-Seam Attachment: Secure one edge of the sheet using fastening plates centered within the roof membrane seam and mechanically fasten sheet to roof deck. Field-weld seam according to manufacturer's seam installation instructions

H. Install sheet and auxiliary materials in accordance with manufacturer's written instructions.

I. Install breather vents, placed between roof membrane fastening tabs, in accordance with manufacturer's written instructions, and at the rate of 1 vent per 10 squares of roofing, minimum 2) required, at locations shown on approved shop drawings.

3.5 SEAM INSTALLATION

A. Clean seam areas, overlap sheets, and weld side and end laps of sheets and flashings according to manufacturer's written instructions to ensure a watertight seam installation. Weld seam using hot air method.

B. Test lap edges with probe to verify seam weld continuity.

C. Repair tears, voids, and lapped seams in roofing that do not meet requirements.

3.6 FLASHING INSTALLATION

A. Install sheet flashings and preformed flashing accessories and adhere to substrate in accordance with roofing system manufacturer's written instructions and [standard] installation details.
1. If required, apply bonding adhesive to substrate and underside of flashing sheet at required rate and allow to partially dry. Do not apply bonding adhesive to seam area of flashing.
2. At walls and vertical surfaces, if there is presence of materials that are not compatible with flashing, install separation sheet as recommended by roofing roof membrane manufacturer's written instructions.

B. Flash penetrations with pre-fabricated flashing assemblies provided by roof membrane manufacturer and field-formed sheet flashing inside and outside corners as recommended by manufacturer.

C. Clean seam areas and overlap sheets. Weld side and end laps to ensure a watertight seam installation.

D. Test lap edges with probe to verify seam weld continuity. Apply lap sealant and seal exposed edges of sheet flashing terminations.

E. Terminate and seal top of sheet flashings and mechanically anchor to substrate through termination bars.

3.7 WALK PAD INSTALLATION

A. Install walk pads in locations indicated. Heat weld or adhere walkway pads to substrate with compatible adhesive according to roofing system manufacturer's written instructions.

3.8 FIELD QUALITY CONTROL

A. Provide roof membrane and insulation manufacturer site inspections as required for the Warranty.

B. Verify field strength of seams a minimum of twice daily, according to manufacturer's written instructions, and repair seam sample areas.

C. Core samples shall be taken when required to evaluate problems observed during quality control inspections of roofing membrane as follows:
1. Cut samples shall be taken when and as recommended by the Manufacturer's Technical Representative, and approved by the Owner's Representative, when determined necessary for quality

control validation or to determine the extent of deficiencies discovered during construction or during final roofing inspection. Except where cut samples are taken to investigate deficiencies, no more than two cut samples per 100 squares or one cut sample from each day's work shall be required. Cut samples at locations identified by the Manufacturer's Technical Representative.

2. Submit core samples to the Manufacturer's Technical Representative for examination. Deficiencies shall be reported by the Manufacturer's Technical Representative.

D. Manufacturer Services:
1. Engage Manufacturer's Technical Representative to provide site inspection and reports.
2. Inspection by the Manufacturer's Technical Representative shall include the following:
   a. Periodic site visits during the roof installation as many times as necessary to ensure adequate observations and proper installation but at least at the following milestones.

      1.) After 30% but prior to 50% of roof installation.
      2.) At 100% completion of roof installation.
      3.) Final Inspection: Two weeks prior to owner acceptance.

   b. Field reports.
   c. Field testing recommendations.
   d. Oversight of remedial repairs in the field.
   e. Verification of completion of magnetic sweeping prior owner acceptance.
   f. Conducting comprehensive roof inspection upon completion of roofing together with all parties to be signators to Roof Inspection
   g. Issuance of Certification of Quality of Roof Construction upon completion of roof installation.

3.9 PROTECTION AND CLEANING

A. Protect membrane roofing system from damage and wear during remainder of construction period. When remaining construction will not affect or endanger roofing, inspect roofing for deterioration and damage, describing its nature and extent in a written report with copies to the Architect.

B. Maintain roof system in watertight condition including repair of conditions that show signs of inferior workmanship that may result in potential leaks. Repair leaks occurring prior to owner acceptance accordance with good roofing practice and the requirements specified herein. Remove and replace wet insulation caused by water leaks and repair the roofing system. Correct deficiencies or remove roofing that does not comply with requirements, repair substrates, reinstall roofing, and repair sheet flashings to a condition free of damage and deterioration at the time of Substantial Completion and according to warranty requirements.

C. Clean debris from adjacent construction using procedures required by the manufacturer of affected construction.

3.10 INFORMATION CARD

A. At completion of work of this Section, provide filled-in information card in the format below. Install card near the point of access to the roof.

INFORMATION CARD

SINGLE - PLY MEMBRANE ROOFING SYSTEM COMPONENTS

Building Number:	Roof Number:
Subcontract Number:	
Deck Type:	Deck Slope:
Dry Sheathing Paper: [ ]Yes [ ] No	
Underlayment Board:	
Insulation Manufacturer:	Thickness:

Type: R-Value:

Sheet Materials Manufacturer:

Sheet Flashing

Bonding Adhesive

Termination Bars & Battens:

Fasteners:

Insulation :

Flashing Material: Weight or Gauge:

Statement of Compliance or Exceptions:

Date of Substantial Completion: Guaranty Period:

Roofing Subcontractor: Name, address, and phone number

Signature _____

Prime Subcontractor: Name, address, and phone number

Signature _____

Roofing Manufacturer: Name, address, and phone number

Signature _____

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Metal soffit panels.

B. Related Sections:
1. Section 05400 - Cold Formed Metal Framing: Steel framing supporting metal soffit.

1.2 REFERENCES

A. The publications listed below form a part of this specification to the extent referenced. Publications are referenced within the text by the basic designation only.

B. American Architectural Manufacturer's Association (AAMA):
1. AAMA 2605 - Specifications, Performance Requirements And Test Procedures For Superior Performing Organic Coatings And Aluminum Extrusions And Panels.

C. ASTM International (ASTM):
1. ASTM A 755/A - Steel Sheet, Metallic Coated by the Hot-Dip Process and Prepainted by the Coil-Coating Process for Exterior Exposed Building Products.
2. ASTM A 792/A - Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process.

1.3 DELIVERY, STORAGE AND HANDLING

A. Section 01600 - Product Requirements: Transport, handle, store, and protect products.

B. Protect panels from accelerated weathering by removing or venting sheet plastic shipping wrap.

C. Deliver panels to site in dry and undamaged condition. Unload and handle in accordance with manufacturer's published instructions.

D. Store panels off ground protected from weather, to prevent twisting, bending, or abrasion, and to provide ventilation.

PART 2 - PRODUCTS

2.1 METAL SOFFIT

A. Metallic-Coated Steel Sheet:
1. Steel Sheet with Organic Coating Finish: Steel sheet metallic coated by the hot-dip process and prepainted by the coil-coating process to comply with ASTM A 755.
2. Steel Sheet with Aluminum or Galvalume Finish: Aluminum-Zinc Alloy-Coated Steel Sheet: ASTM A 792, Class AZ50 coating designation, Grade 40; structural quality.

B. Manufacturer: Subject to compliance with requirements, provide product equivalent to those specified by any one of the following manufacturers:
1. AEP-SPAN; Dallas, TX; (800) 527-2503.
2. Berridge Manufacturing Co., Houston, TX; (800) 231-8127.
3. Fabral Metal Roof and Wall Systems, Lancaster, PA (800) 884-4484.
4. MBCI: Houston, TX; (800) 861-6224
5. McElroy Metal, Bossier City, LA, (800) 950-6531.

6. PAC-CLAD, Petersen Aluminum Corporation, Elk Grove Village, IL (800) 722--2523.

C. Description:
1. Exterior Soffit: Flush Panel with Ribs, .032 aluminum panel, Marquee-Lok, Ribbed option by McElroy Metals or equal. Seam Spacing: 12 inches.

2.2 ACCESSORIES

A. Provide manufacturer's standard accessories and other special items required and essential to completeness of soffit installation. Sight-exposed accessories shall match finish of metal soffit system.
1. Trim Items: Of same material and finish as soffit sheets.
2. Fasteners: As recommended by soffit system manufacturer for intended purpose.
3. Sealants: Color coordinated primerless silicone or high grade non-drying butyl, recommended by panel manufacturer.

2.3 FABRICATION

A. Factory fabricate and finish panels and accessories ready for field assembly.

B. Form sections true to shape, accurate in size, square, and free from distortion.

C. Fabricate panels in one piece. Fabricate accessories in longest practicable lengths.

2.4 FINISHES

A. Factory finish surfaces with high performance pigmented organic coating. Prepare, pretreat, and apply coating to exposed metal surfaces in conformance with coating and resin manufacturer's instructions providing finish free of scratches and other blemishes.
1. Finish: Manufacturer's standard 2-coat, thermocured system composed of specially formulated inhibitive primer and fluoropolymer color topcoat containing minimum of 70 percent Penwalt Kynar 500 resin by weight with total minimum dry film thickness of 1.0 mil and 30 percent reflective gloss when tested in accordance with ASTM D 523 and complying with physical properties and coating performance requirements of AAMA 2605, except Humidity Resistance and Salt Spray Resistance shall be 2000 hours
2. Color: To be selected by architect

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine building structure and adjacent areas where panels will be installed. Do not proceed with Work until unsatisfactory conditions have been corrected.
1. Examine soffit structure to verify that structure is ready for soffit panel installation.
2. Verify field dimensions to determine compliance with panel manufacturer's tolerances.

B. Beginning of installation indicates acceptance of existing conditions.

3.2 INSTALLATION

A. Install soffit panels in accordance with manufacturer's published instructions.

B. Secure panel in place with concealed fasteners.

C. Interlock panels and secure in place to prevent warping and wracking.

D. Back paint surfaces in contact with dissimilar materials.

3.3 FIELD QUALITY CONTROL

A. Inspect soffit panel installation, alignment, attachments, trim, and accessories.

3.4 CLEANING

A. Wipe clean each soffit panel after erection.

B. Replace damaged panels and other components of Work which cannot be repaired by finish touch-up or similar minor repairs.

C. Remove from finished surface, filing caused by drilling and cutting of panels.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Fascia trim.
2. Counterflashing over base flashing.

B. Related Sections:
1. Section 04200 - Unit Masonry Assemblies: Metal reglets and through-wall flashing for masonry.
2. Section 06100 - Rough Carpentry: Wood blocking and nailers.
3. Section 07711 - Gutters and Downspouts.
4. Section 07901 - Joint Sealants.
5. Section 09900 - Painting.

1.2 REFERENCES

A. The publications listed below form a part of this specification to the extent referenced. Publications are referenced within the text by the basic designation only.

B. American Architectural Manufacturers Association (AAMA):
1. AAMA 621 - Voluntary Specifications for High Performance Organic Coatings on Coil Coated Architectural Hot Dipped Galvanized (HDG) and Zinc-Aluminum Coated Steel Substrates.

C. ASTM International (ASTM):
1. ASTM A 653 - Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
2. ASTM A 755/A - Steel Sheet, Metallic Coated by the Hot-Dip Process and Prepainted by the Coil-Coating Process for Exterior Exposed Building Products.
3. ASTM A 792/A - Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process
4. ASTM B 749 - Lead and Lead Alloy Strip, Sheet, and Plate Products
5. ASTM D 523 - Standard Test Method for Specular Gloss
6. ASTM D 4586 - Asphalt Roof Cement, Asbestos Free.

D. National Roofing Contractors Association (NRCA):
1. NRCA - Low Slope Roofing Manual.

E. Sheet Metal and Air Conditioning Contractors National Association (SMACNA):
1. SMACNA - Architectural Sheet Metal Manual, Fifth Edition, 1993.

F. Steel Structures Painting Council (SSPC):
1. SSPC-Paint 12 - Cold-Applied Asphalt Mastic (Extra Thick Film).

1.3 SUBMITTALS

A. Contract Closeout Submittals: Submit the following under provisions of Section 01770.
1. Letter of Certification: Submit certification from sheet metal supplier verifying quality of galvanized steel sheet materials.

1.4 QUALITY ASSURANCE

A. Perform work in accordance with SMACNA "Architectural Sheet Metal Manual" and NRCA "Low Slope Roofing Manual" standard details and requirements.

B. Supplier Certification: Provide certification from galvanized sheet steel supplier stating that materials conform to ATSM A 653, G90 hot-dipped galvanized steel.

1.5 DELIVERY, STORAGE AND HANDLING

A. Stack preformed material to prevent twisting, bending, or abrasion, and to provide ventilation.

B. Prevent contact with materials during storage that may cause discoloration, staining, or damage.

PART 2 - PRODUCTS

2.1 SHEET MATERIALS

A. Galvanized Steel: ASTM A 653 Commercial Quality and Lock-Forming Quality, G90 coating designation hot-dip galvanized, mill phosphatized for painting where exposed to view from ground level. Sheet metal gages shall be as shown or as follows where not shown:
1. Flashing and Counter Flashing: 24 gage.
2. Fascia Trim: 24 gage.

2.2 ACCESSORIES

A. Fasteners: Galvanized steel finish exposed fasteners to match flashing metal. Furnish exposed fasteners with soft EPDM washers as manufactured by the following:
1. Tap - Fast Screws, by Hilti.
2. Trugrip GT, by ITW Buildex.

B. Sealant: Specified in Section 07901.

C. Bituminous Coating: SSPC - Paint 12, solvent-type bituminous mastic, nominally free of sulfur, compounded for 15 mil dry film thickness per coat.

D. Draw Band: Stainless steel.

2.3 FABRICATION

A. Form sections true to shape, accurate in size, square, and free from distortion or defects.

B. Fabricate cleats of same material as sheet, interlockable with sheet.

C. Form pieces in longest possible lengths.

D. Hem exposed edges on underside 1/2 inch; miter and seam corners.

E. Fabricate corners to form one piece with minimum 18 inches long legs; rivet for rigidity.

F. Fabricate vertical faces with bottom edge formed outward 1/4 inch and hemmed to form drip.

G. Fabricate flashings to allow toe to extend 4 inches over roofing. Return and brake edges.

H. Fabricate exposed sheet metal components with provisions for thermal expansion.

2.4 FINISH

A. Fascia Trim: Prefinished to match Standing Seam Metal Roof as selected by Architect.

B. Flashing and counterflashing: Paint metal surfaces exposed to view from ground level in accordance with Section 09900, and as indicated on Drawings, unless otherwise shown to be prefinished.

PART 3 - EXECUTION

3.1 INSPECTION

A. Verify roof openings, curbs, pipes, sleeves, ducts, or vents through roof are solidly set.

B. Verify roofing membrane termination and base flashings are in place, sealed, and secure.

C. Beginning of installation means acceptance of existing conditions.

3.2 PREPARATION

A. Field measure site conditions prior to fabricating work.

B. Install starter and edge strips, and cleats before starting installation.

3.3 INSTALLATION

A. Install sheet metal flashing and trim in accordance with applicable details of SMACNA "Architectural Sheet Metal Manual" and NRCA "Low Slope Roofing Manual." Anchor units of work securely in place by methods indicated, providing for thermal expansion of metal units; conceal fasteners where possible, and set units true to line and level. Install work with laps, joints, and seams that will be permanently watertight and weatherproof.

B. Bed flanges of metal flashings in plastic cement or sealing mastic where required for waterproof performance.

C. Apply bituminous coating on surfaces in contact with dissimilar materials including the following:
1. Dissimilar metals as defined in SMACNA Appendix A-3.
2. Preservative treated wood.

D. Reglet and Counterflashing System:
1. Surfaced Mounted Reglet:
   a. Set reglet parallel to roof line in full bed of sealant. Provide minimum 2 inch end lap at continuous elevations.
   b. Secure to wall with neoprene/stainless steel washers and drive pins at maximum 16 inches on center.
   c. Provide a continuous, full bead of sealant at top edge of reglet between flashing and wall. Sealant bead shall be of sufficient width to provide a 45 degree angle with vertical surface.
2. Masonry Joint Reglet: Specified in Section 04200.
3. Counterflashing: Provide counterflashing of the type indicated or required to match reglet system. Insert counterflashings into reglets to form tight fit. Counterflashing shall be installed in such a manner as to provide for continuous contact at base flashing with sufficient pressure at point of contact to prevent dislocation. Lap inside corners. Notch and hook-seam outside corners. Set laps and seams in sealant.

a. Provide minimum 2" end lap at continuous elevations.
b. Change in elevation of 4", provide 8" end lap.
c. Change in elevation of 8", provide 12" end lap.

END OF SECTION

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Special Conditions apply to this Section.

1.2 SUMMARY

A. This section includes, but is not limited to:

1. Manufactured curbs.

1.3 RELATED SECTIONS

A. Section 05300 – Steel Deck.

1.4 REFERENCES

A. ASTM A 653/A 653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2006a.

1.5 SUBMITTALS

A. Product Data: Manufacturer's data sheets on each product to be used, including:

1. Preparation instructions and recommendations.
2. Storage and handling requirements and recommendations.
3. Installation methods.
4. Maintenance requirements.

1.6 DELIVERY, STORAGE, AND PROTECTION

A. Store products in manufacturer's unopened packaging until ready for installation.

B. Store products under cover and elevated above grade.

PART 2 PRODUCTS

2.1 MANUFACTURED CURBS

A. Manufactured Curbs, Equipment Rails, and Other Roof Mounting Assemblies: Factory-assembled hollow sheet metal construction with fully mitered and welded corners, integral counterflashing, internal reinforcing, and top side and edges formed to shed water.

1. Sheet Metal: Hot-dip zinc coated steel sheet complying with ASTM A 653/A 653M, SS Grade 33 (230); G60 (Z180) coating designation; 18 gage, 0.048 inch (1.21 mm) thick.

2. Roofing Cants: Provide integral sheet metal roofing cants dimensioned to begin slope at top of roofing insulation; 1:1 slope; minimum cant height 4 inches (200 mm).

3. Manufacture curb bottom and mounting flanges for installation directly on roof deck, not on insulation; match slope and configuration of roof deck.

4. Provide the layouts and configurations shown on the drawings.

B. Curbs Adjacent to Roof Openings: Provide curb on all sides of opening, with top of curb horizontal for equipment mounting.

1. Provide preservative treated wood nailers along top of curb.

2. Insulate inside curbs with 1-1/2 inch (38 mm) thick fiberglass insulation.

3. Height Above Finished Roof Surface: 6 inches (152 mm), minimum.

4. Height Above Roof Deck: 14 inches (356 mm), minimum.

PART 3 EXECUTION

3.1 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.3 INSTALLATION

A. Install in accordance with manufacturer's instructions, in manner that maintains roofing weather integrity.

3.4 CLEANING AND PROTECTION

A. Clean installed work to like-new condition.

B. Protect installed products until completion of project.

C. Touch-up, repair or replace damaged products before Substantial Completion

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Galvanized steel gutters and downspouts, with expansion joints.
2. Downspout collectors.
3. Conductor heads.

B. Related Sections:
1. Section 07620 - Sheet Metal Flashings and Trim.
2. Section 07901 - Joint Sealants.
3. Section 09900 - Painting: Field painting of metal surfaces.

1.2 REFERENCES

A. The publications listed below form a part of this specification to the extent referenced. Publications are referenced within the text by the basic designation only.

B. ASTM International (ASTM):
1. ASTM A 123 - Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
2. ASTM A 283 - Low and Intermediate Tensile Strength Carbon Steel Plates.
3. ASTM A 653 - Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

C. Sheet Metal and Air Conditioning Contractors National Association (SMACNA):
1. Architectural Sheet Metal Manual.

D. Steel Structures Painting Council (SSPC):
1. SSPC - Paint 12 - Cold-Applied Asphalt Mastic (Extra Thick Film).

1.3 QUALITY ASSURANCE

A. Nominal sizing of components for rainfall intensity determined by a storm occurrence of 1 in 5 years shall be as indicated on Drawings.

1.4 DELIVERY, STORAGE AND HANDLING

A. Stack preformed materials to prevent twisting, bending, or abrasion, and to aid ventilation. Slope to drain.

B. Prevent contact with materials during storage which may cause discoloration, staining, or damage.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Galvanized Steel Sheet: ASTM A 653 Structural Quality, Grade 33, G90 zinc coating.

B. Galvanized Steel Plate: ASTM A 283, Grade A; hot-dipped galvanized G90 coating complying with ASTM A123.

2.2 COMPONENTS

A. Hanging Gutters: Fabricate to cross section indicated, complete with end pieces, outlet tubes, and other accessories as required. Fabricate in minimum 96-inch long sections. Furnish flat-stock gutter spacers and gutter brackets fabricated from same metal as gutters, of size recommended by SMACNA but not less than twice the gutter thickness. Fabricate expansion joints, expansion-joint covers, and gutter accessories from same metal as gutters. SMACNA rectangular profile, Figure 1-2, Style D, gauge as follows:
1. 6”x 6”: 24 gauge.

B. Downspouts: 22 gauge; SMACNA rectangular. Fabricate downspouts complete with mitered elbows. Furnish with metal hangers, from same material as downspouts, and anchors. Downspouts shall be fully enclosed profile, Figure 1-32B.

C. Conductor Head: SMACNA Figure 1-25F.

2.3 ACCESSORIES

A. Gutter Brackets: Galvanized steel plate, 3/16 inch thick by 2 inches wide bent plate.

B. Gutter Spacer Clip: Galvanized steel sheet, gauge to match gutter.

C. Gutter Strap: Galvanized steel sheet size and spacing as shown.

D. Downspout/Gutter Connections: SMACNA rectangular profile, Figure 1-33B, Detail 1, gauge to match gutter.

E. Downspout Straps: Galvanized steel sheet; 20 gauge, SMACNA Figure 1-35G.

F. Bituminous Coating: SSPC - Paint 12, solvent-type bituminous mastic, nominally free of sulfur, compounded for 15 mil dry film thickness per coat.

G. Sealant: Specified in Section 07901.

H. Splash Blocks (if indicated on Drawings): Precast concrete units, minimum 3000 psi at 28 days, with 5 percent air entrainment, size and profile to suit application.

I. Downspout Collectors (if indicated on Drawings): Pipe material, sizes, connections, dimensions and profiles to suit downspouts and underground storm drainage system as indicated on drawings.

2.4 FABRICATION

A. Form gutters and downspouts of size indicated on Drawings.

B. Fabricate in accordance with SMACNA details unless otherwise shown.

C. Provide gutter spacers at spacing shown. Fasten to front and back of gutter.

D. Field measure site conditions prior to fabricating work.

E. Form sections square, true, and accurate in size, in maximum possible lengths and free of distortion or defects detrimental to appearance or performance. Allow for expansion at joints.

F. Hem exposed edges of metal.

G. Field Finishing (if indicated on Drawings to be painted): Field paint gutter, downspouts, and accessories surfaces exposed to view from ground surface. Paint in accordance with Section 09900.

H. Factory Finish (if indicated on Drawings to be prefinished): Kynar finish shall be equal to finish of metal roof panels specified in Section 07412.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that surfaces are ready to receive work and conditions are acceptable.

B. Verify surfaces behind gutters and downspouts are painted prior to installation. Gutters, downspouts, and conductor heads shall not be in place while surfaces behind such items are being painted.

C. Beginning of installation indicates acceptance of existing conditions and substrate.

3.2 INSTALLATION

A. Install gutters, brackets, and accessories in accordance with SMACNA Figure 1-12 and as shown on the Drawings.
   1. Install gutters level without sags or dips to prevent ponding.
   2. Gutter Brackets: Space alternately with gutter spacers at 36 inches on center.
      a. Attachment to Masonry: Anchor to masonry bond beam as shown. Space anchor bolts minimum of 3 inches apart.
      b. Attachment to Steel: Weld to steel tube section with 3/16 inch by 2 inches fillet weld, both sides of bracket. Begin weld at top of bracket.
   3. Lap gutter joints 2 inches, set laps in bead of sealant, and rivet at 1 inch on center.
   4. Provide lap type gutter expansion joint in accordance with SMACNA Figure 1-6. Locate joints at a maximum spacing of 40 feet with at least one expansion joints in each segment of gutter between ends and/or downspouts.

B. Install downspouts in accordance with SMACNA Figure 1-35A, space straps at 48 inches on center.

C. Install conductor heads and downspouts after application of exterior wall coating.

D. Apply bituminous coating on surfaces in contact with dissimilar materials including the following:
   1. Dissimilar metals as defined in SMACNA Appendix A-3 and backside of conductor heads, gutters and downspouts.
   2. Preservative treated wood.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Firestopping in rated assemblies.

1.2 REFERENCES

A. The publications listed below form a part of this specification to the extent referenced. Publications are referenced within the text by the basic designation only.

B. ASTM International (ASTM):
1. ASTM E 84 - Surface Burning Characteristics of Building Materials
2. ASTM E 814 - Fire Tests of Through Penetration Fire Stops.

C. Underwriters' Laboratories, Inc. (UL):
1. UL 1479 - Fire Tests of Through-Penetration Firestops.
2. UL 2079 – Tests for Fire Resistance of Building Joint Systems.
3. UL Fire Resistance Directory:
4. International Firestop Council Guidelines for Evaluating Firestop Systems Engineering Judgements

1.3 SUBMITTALS

A. Certifications:
1. Certifications of installer qualifications.
2. Certificaton of manufacturer’s inspection.

1.4 CONTRACTOR QUALIFICATIONS

A. Installation of firestopping shall be by a Designated Responsible Individual (DRI) in accordance with FM 4991 or shall be an approved installer by the Firestop Manufacturer. Submit documentation of the DRI or a letter from the manufacterer naming the approved installer to the Architect prior to commencement of firestop work.

1.5 ENVIRONMENTAL REQUIREMENTS

A. During application of caulk and putty, keep away from heat, open flame, sparks, or other sources of ignition until product cures. Use only with adequate ventilation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with requirements, provide firestopping products as manufactured by one of the following:
1. Nelson Firestop Products, (800) 331-7325.
2. Hilti, Inc, (800) 879-8000.
3. The RectorSeal Corporation, (800) 231-3345.
4. Specified Technologies, Inc. (STI), (800) 992-1180.
5. 3M Fire Protection Products, (800) 376-0964.

6. Tremco Firestop System, (800) 852-8173.

2.2 MATERIALS

A. Firestop materials shall have been tested with and shall be in compliance with the minimum requirements of ASTM E814, UL 1479, and UL 2079 as applicable. Products used shall be as listed below as suitable for the intended application and as required to produce the fire rating as shown on the drawings and to conform to the Firestopping Schedule of UL assemblies included at the end of this Section.

B. Intumescent Latex or Acrylic Sealant: Single-component, intumescent, latex or acrylic formulation.
1. LBS by Nelson Firestop Products.
2. FS ONE or CP 606 by Hilti.
3. Metacaulk 950 or 1000 by RectorSeal.
4. SpecSeal SSS100 by STI.
5. CP 25WB+, IC 15WB, or 3000WT by 3M.
6. TREMstop Intumescent Acrylic (IA) or Acrylic (A) by Tremco.

C. Intumescent Solvent-Release-Curing Sealant: Single component, intumescent, synthetic-polymer based, non-sag grade.
1. CP 25N/S by 3M.

D. Intumescent Wrap/Strip: Single-component, elastomeric sheet with aluminum foil on one face.
1. WRS by Nelson Firestop Products.
2. CP 645 Wrap Strip by Hilti.
3. Metacaulk Wrap Strip by RectorSeal.
4. SpecSeal SSWRED Wrapstrip by STI.
5. FS-195+ Wrap/Strip or Ultra GS by 3M.
6. TREMstop WS by Tremco.

E. Intumescent Putty: Single-component, non-hardening, dielectric, intumescent putty.
1. FSP by Nelson Firestop Products.
2. CP 618 Putty Stick or CP 617/617L Putty Pad by Hilti.
3. CP 645 Wrap Strip by Hilti.
4. CP 658 Firestop Plug by Hilti.
5. Metacaulk Fire Rated Putty by RectorSeal.
6. SpecSeal Putty by STI.
7. Moldable Putty+ by 3M.
8. TREMstop MP (Moldable Putty) or Putty Stick by Tremco.

F. Silicone Sealant: Single-component, moisture-curing, silicone-based elastomeric, non-sag grade.
1. CLK N/S by Nelson Firestop Products.
2. CP 601S by Hilti.
3. Metacaulk 835 by RectorSeal.
4. SpecSeal PEN 300 by STI.
5. 2000+ Silicone by 3M.
6. FYRE-SIL or SL by Tremco.

G. Silicone or Polyurethane Foam: Two-Component, liquid elastomer that, when mixed, expands and cures in place to produce a flexible, nonshrinking foam.
1. SpecSeal PEN 200 by STI.

2. 2001 Silicone RTV Foam by 3M.
3. CP 620 Fire Foam by Hilti.

H. Intumescent Collar: Factory-fabricated, intumescent collar.
1. PCS by Nelson Firestop Products.
2. CP 642 or CP 643 by Hilti.
3. Metacaulk Pipe Collar by RectorSeal.
4. SpecSeal SSC Collars by STI.
5. Plastic Pipe Device, RC Pack, or RC One Collar by 3M.
6. TREMstop D by Tremco.

I. Intumescent Composite Sheet, Pillows and Mortar, or Blocks: Products used to firestop large openings.
1. CPS by Nelson Firestop Products.
2. FS 657 Fireblocks by Hilti.
3. CP 637 Firestop Mortar by Hilti.
4. CP 675T Firestop Board by Hilti.
5. SpecSeal SSB Pillows and SpecSeal SSM Firestop Compound by STI.
6. CS-195+ Composite Sheet by 3M.
7. TREMstop PS by Tremco.

J. Sprayable Fire-Rated Mastic: Products used to firestop construction joints.
1. CP672 Speed Spray by Hilti.
2. Specseal Elastomeric Spray by STI.
3. Firedam Spray 200 by 3M.
4. TREMstop Acrylic Spray (A-SP) by Tremco.

K. Packing Material: Manufacturer's standard mastic, putty, ceramic fiber blanket, or mineral wool to be used as fill or backing material for firestopping.
1. FSB or Mineral Wool by Nelson Firestop Products.
2. Mineral Wool by Hilti.
3. Fire Safing or Backer Rod by RectorSeal.
4. Mineral Wool by STI.
5. Fire Barrier 5A,15A, and 20A or PM4 Packing Material by 3M.
6. TREMstop FS Blanket by Tremco.
7. CP 777 Speed Plugs by Hilti. (preformed mineral wool designed for top of wall fluted metal deck packing material)

L. Substitutions: Not Permitted.

PART 3 - EXECUTION

3.1 PREPARATION

A. Remove loose dirt and oil from penetration surfaces.

B. Place hangers or damming materials in penetration to hold firestopping materials, if necessary.

3.2 INSTALLATION

A. Follow manufacturer charts for appropriate material to achieve required fire rating in various locations.

B. Install firestopping at penetrations of fire rated wall materials in accordance with manufacturer's published instructions.

C. Install firestopping at penetrations and construction joints of fire rated walls and floors in accordance with manufacturer's published instructions and in accordance with UL Fire Resistance Directory.

3.3 FIELD QUALITY CONTROL

A. Site Inspection: Upon completion of installation, inspection of installed firestopping shall be made by a qualified manufacturer's representitive to verify work complies with the manufacturers requirements. Submit written certification to the Architect that Manufacturer has visited the site and the work is in accordance with manufacturer's requirements and published instructions.

3.4 SCHEDULES

A. Provide firestopping complying with UL assemblies specified below.

B.

Penetration	Assembly	Nelson	Hilti	RectorSeal	STI	3M	Tremco
Metal Pipe	CMU Wall 8" Thick or Less	CAJ1203	CAJ 1149 or CAJ1155 or CAJ1226	CAJ1114 or CAJ1115	CAJ1079 or CAJ1217	CAJ1001 or CAJ1009	CAJ1064 or CAJ1302
	Gypsum Board Partition	WL1083 or WL1030	WL1054 or WL1058	WL1026 or WL1034	WL1049 or WL1079	WL1003 or WL1009	WL1278 or WL1158
Non-Metallic Pipe	CMU Wall 8" Thick or Less	CAJ2086	CAJ2110 or CAJ2109	WJ2025	CAJ2064 or CAJ2045	CAJ2005	CAJ2233 or CAJ2184
	Gypsum Board Partition	WL2071	WL2098 or WL2078 or WL2341	WL2104	WL2093, WL2029 or WL2288	WL2002 or WL2005	WL2083 or WL2129
Cable Tray	CMU Wall 8" Thick or Less	CAJ8049 or CAJ4033	CAJ4035 or CAJ4017	CAJ8043	CAJ4020 or CAJ4029	CAJ4003	CAJ4075
	Gypsum Board Partition	WL4003	WL4011 or WL4019	- - - -	WL4005 or WL4008	WL4004	WL3043
Insulated Metal Pipe	CMU Wall 8" thick or Less	CAJ5008 or CAJ5059	CAJ5090 or CAJ5091	WJ5016 or CAJ5070	CAJ5021 or CAJ5029	CAJ5001 or CAJ5002	CAJ5121 CAJ5111
	Gypsum Board Partition	WL5036	WL5028 or WL5029	WL5057	WL5014 or WL5051	WL5001	WL-5115 WL-5081
Construction Gaps - Wall to Wall	CMU Wall to CMU Wall	- - - -	WWD1011, WWD1012or WWD0017	- - - -	- - - -	WWS1001	WWD1050, WWD0043, TL/PV60-01 or WWD-1052

Penetration	Assembly	Nelson	Hilti	RectorSeal	STI	3M	Tremco
	Gyp Bd Parti'n to Gyp Bd Parti'n	- - - -	- - - -	- - - -	- - - -	WWS0004	- - - -

END OF SECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes joint sealants for the following locations:
   1. Exterior joints in vertical surfaces and non-traffic horizontal surfaces as indicated below:
      a. Control and expansion joints in unit masonry.
      b. Perimeter joints between materials listed above and frames of doors and windows.
      c. Other joints as indicated.
   2. Exterior joints in horizontal traffic surfaces as indicated below:
      a. Control, expansion, and isolation joints in cast-in-place concrete slabs.
      b. Other joints as indicated.
   3. Interior joints in vertical surfaces and horizontal nontraffic surfaces as indicated below:
      a. Perimeter joints of exterior openings where indicated.
      b. Tile control and expansion joints.
      c. Vertical control joints on exposed surfaces of interior unit masonry and concrete walls and partitions.
      d. Perimeter joints between interior wall surfaces and frames of interior doors, windows, and elevator entrances.
      e. Perimeter joints of toilet fixtures.
      f. Other joints as indicated.
   4. Interior joints in horizontal traffic surfaces as indicated below:
      a. Control and expansion joints in cast-in-place concrete slabs.
      c. Control and expansion joints in tile flooring.
      d. Other joints as indicated.

1.3 SYSTEM PERFORMANCE REQUIREMENTS

A. Provide elastomeric joint sealants that have been produced and installed to establish and to maintain watertight and airtight continuous seals without causing staining or deterioration of joint substrates.

B. Provide joint sealants for interior applications that have been produced and installed to establish and maintain airtight continuous seals that are water resistant and cause no staining or deterioration of joint substrates.

1.4 SUBMITTALS

A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.

B. Product data from manufacturers for each joint sealant product required.
   1. Certification by joint sealant manufacturer that sealants plus the primers and cleaners required for sealant installation comply with local regulations controlling use of volatile organic compounds.

C. Samples for verification purposes of each type and color of joint sealant required. Install joint sealant samples in 1/2-inch (13-mm) wide joints formed between two 6-inch (150-mm) long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.

D. Compatibility and adhesion test reports from elastomeric sealant manufacturer indicating that materials forming joint substrates and joint sealant backings have been tested for compatibility and adhesion with joint sealants. Include sealant manufacturer's interpretation of test results relative to sealant performance and recommendations for primers and substrate preparation needed to obtain adhesion.

E. Product test reports for each type of joint sealants indicated, evidencing compliance with requirements specified.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced Installer who has completed joint sealant applications similar in material, design, and extent to that indicated for Project that have resulted in construction with a record of successful in-service performance.

B. Single Source Responsibility for Joint Sealant Materials: Obtain joint sealant materials from a single manufacturer for each different product required.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Project site in original unopened containers or bundles with labels indicating manufacturer, product name and designation, color, expiration period for use, pot life, curing time, and mixing instructions for multi-component materials.

B. Store and handle materials in compliance with manufacturer's recommendations to prevent their deterioration or damage due to moisture, high or low temperatures, contaminants, or other causes.

1.7 PROJECT CONDITIONS

A. Environmental Conditions: Do not proceed with installation of joint sealants under the following conditions:
   1. When ambient and substrate temperature conditions are outside the limits permitted by joint sealant manufacturer.
   2. When ambient and substrate temperature conditions are outside the limits permitted by joint sealant manufacturer or below 40 deg F (4 deg C).
   3. When joint substrates are wet.

B. Joint Width Conditions: Do not proceed with installation of joint sealants where joint widths are less than allowed by joint sealant manufacturer for application indicated.

C. Joint Substrate Conditions: Do not proceed with installation of joint sealants until contaminants capable of interfering with their adhesion are removed from joint substrates.

1.8 SEQUENCING AND SCHEDULING

A. Sequence installation of joint sealants to occur not less than 21 nor more than 30 days after completion of waterproofing, unless otherwise indicated.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. Compatibility: Provide joint sealants, joint fillers, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.

B. Colors: Provide color of exposed joint sealants to comply with the following:
1. Provide selections made by Architect from manufacturer's full range of standard colors for products of type indicated.

2.2 ELASTOMERIC JOINT SEALANTS

A. Elastomeric Sealant Standard: Provide manufacturer's standard chemically curing elastomeric sealants that comply with ASTM C 920 and other requirements indicated on each Elastomeric Joint Sealant Data Sheet at end of this Section, including those requirements referencing ASTM C 920 classifications for Type, Grade, Class, and Uses.
1. Additional Movement Capability: Where additional movement capability is specified in Elastomeric Joint Sealant Data Sheet, provide products with the capability, when tested for adhesion and cohesion under maximum cyclic movement per ASTM C 719, to withstand the specified percentage change in the joint width existing at time of installation and remain in compliance with other requirements of ASTM C 920 for Uses indicated.

B. Products: Subject to compliance with requirements, provide one of the following products: DOW Silicone Sealant 795.

2.3 LATEX JOINT SEALANTS

A. General: Provide manufacturer's standard one-part, non-sag, mildew-resistant, paintable latex sealant of formulation indicated that is recommended for exposed applications on interior and protected exterior locations and that accommodates indicated percentage change in joint width existing at time of installation without failing either adhesively or cohesively.

B. Acrylic-Emulsion Sealant: Provide product complying with ASTM C 834 that accommodates joint movement of not more than 5 percent in both extension and compression for a total of 10 percent.

C. Silicone Emulsion Sealant: Provide product complying with ASTM C 834 and, except for weight loss measured per ASTM C 792, with ASTM C 920 that accommodates joint movement of not more than 25 percent in both extension and compression for a total of 50 percent.

D. Available Products: Subject to compliance with requirements, latex joint sealants that may be incorporated in the Work include, but are not limited to, the following:

E. Products: Subject to compliance with requirements, provide one of the following:
1. Acrylic-Emulsion Sealant:
   a. "AC-20," Pecora Corp.
   b. "Sonolac," Sonneborn Building Products Div., ChemRex, Inc.
   c. "Tremco Acrylic Latex 834," Tremco, Inc.
2. Silicone-Emulsion Sealant:

a. "Trade Mate Paintable Glazing Sealant," Dow Corning Corp.

2.4 JOINT SEALANT BACKING

A. General: Provide sealant backings of material and type that are nonstaining; are compatible with joint substrates, sealants, primers and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

B. Plastic Foam Joint Fillers: Preformed, compressible, resilient, nonstaining, nonwaxing, nonextruding strips of flexible plastic foam of material indicated below and of size, shape, and density to control sealant depth and otherwise contribute to producing optimum sealant performance:
1. Open-cell polyurethane foam.
2. Closed-cell polyethylene foam, nonabsorbent to liquid water and gas, nonoutgassing in unruptured state.
3. Proprietary, reticulated, closed-cell polymeric foam, nonoutgassing, with a density of 2.5 pcf (40 kg/cu. m) and tensile strength of 35 psi (240 kPa) per ASTM D 1623, and with water absorption less than 0.02 g/cc per ASTM C 1083.
4. Any material indicated above.

C. Elastomeric Tubing Joint Fillers: Neoprene, butyl, EPDM, or silicone tubing complying with ASTM D 1056, nonabsorbent to water and gas, capable of remaining resilient at temperatures down to -26 deg F (-32 deg C). Provide products with low compression set and of size and shape to provide a secondary seal, to control sealant depth, and otherwise contribute to optimum sealant performance.

D. Bond-Breaker Tape: Polyethylene tape or other plastic tape as recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint filler materials or joint surfaces at back of joint where such adhesion would result in sealant failure. Provide self-adhesive tape where applicable.

2.9 MISCELLANEOUS MATERIALS

A. Primer: Material recommended by joint sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint sealant-substrate tests and field tests.

B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming in any way joint substrates and adjacent nonporous surfaces, and formulated to promote optimum adhesion of sealants with joint substrates.

C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with

requirements for joint configuration, installation tolerances, and other conditions affecting joint sealant performance. Do not proceed with installation of joint sealants until unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with recommendations of joint sealant manufacturer and the following requirements:
   1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
   2. Clean concrete, masonry, unglazed surfaces of ceramic tile, and similar porous joint substrate surfaces by brushing, grinding, blast cleaning, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining from above cleaning operations by vacuuming or blowing out joints with oil-free compressed air.
   3. Remove laitance and form release agents from concrete.
   4. Clean metal, glass, porcelain enamel, glazed surfaces of ceramic tile, and other nonporous surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants.

B. Joint Priming: Prime joint substrates where indicated or where recommended by joint sealant manufacturer based on preconstruction joint sealant-substrate tests or prior experience. Apply primer to comply with joint sealant manufacturer's recommendations. Confine primers to areas of joint sealant bond; do not allow spillage or migration onto adjoining surfaces.

C. Masking Tape: Use masking tape where required to prevent contact of sealant with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.3 INSTALLATION OF JOINT SEALANTS

A. General: Comply with joint sealant manufacturer's printed installation instructions applicable to products and applications indicated, except where more stringent requirements apply.

B. Sealant Installation Standard: Comply with recommendations of ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

C. Installation of Sealant Backings: Install sealant backings to comply with the following requirements:
   1. Install joint fillers of type indicated to provide support of sealants during application and at position required to produce the cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
      a. Do not leave gaps between ends of joint fillers.
      b. Do not stretch, twist, puncture, or tear joint fillers.
      c. Remove absorbent joint fillers that have become wet prior to sealant application and replace with dry material.
   2. Install bond breaker tape between sealants where backer rods are not used between sealants and joint fillers or back of joints.

D. Installation of Sealants: Install sealants by proven techniques that result in sealants directly contacting and fully wetting joint substrates, completely filling recesses provided for each joint configuration, and providing uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability. Install sealants at the same time sealant backings are installed.

E. Tooling of Non-sag Sealants: Immediately after sealant application and prior to time skinning or curing begins, tool sealants to form smooth, uniform beads of configuration indicated, to eliminate air pockets, and to ensure contact and adhesion of sealant with sides of joint. Remove excess sealants from surfaces adjacent to joint. Do not use tooling agents that discolor sealants or adjacent surfaces or are not approved by sealant manufacturer.
1. Provide concave joint configuration per Figure 5A in ASTM C 1193, unless otherwise indicated.
2. Provide flush joint configuration, per Figure 5B in ASTM C 1193, where indicated.
3. Provide recessed joint configuration, per Figure 5C in ASTM C 1193, of recess depth and at locations indicated.
    a. Use masking tape to protect adjacent surfaces of recessed tooled joints.

3.4 CLEANING

A. Clean off excess sealants or sealant smears adjacent to joints as work progresses by methods and with cleaning materials approved by manufacturers of joint sealants and of products in which joints occur.

3.5 PROTECTION

A. Protect joint sealants during and after curing period from contact with contaminating substances or from damage resulting from construction operations or other causes so that they are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately so that and installations with repaired areas are indistinguishable from original work.

END OF SECTION

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 steel doors and frames.

B. Related Sections: The following Sections contain requirements that relate to this Section:
1. Section 04200 - Unit Masonry Assemblies: for building anchors into and grouting frames in masonry construction.
2. Section 08211 - Flush Wood Doors: for hollow-core and solid-core wood doors installed in steel frames.
3. Section 08710 - Door Hardware: for door hardware and weather stripping.
4. Section 08800 - Glazing: for glass in steel doors and sidelights.
5. Section 09250 - Gypsum Board: for spot grouting frames in gypsum board partitions.
6. Section 09900 - Painting: for field painting primed doors and frames.

1.3 SUBMITTALS

A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.

B. Product Data for each type of door and frame specified, including details of construction, materials, dimensions, hardware preparation, core, label compliance, sound ratings, profiles, and finishes.

C. Shop Drawings showing fabrication and installation of steel doors and frames. Include details of each frame type, elevations of door design types, conditions at openings, details of construction, location and installation requirements of door and frame hardware and reinforcements, and details of joints and connections. Show anchorage and accessory items.

D. Door Schedule: Submit schedule of doors and frames using same reference numbers for details and openings as those on Contract Drawings.
1. Indicate coordination of glazing frames and stops with glass and glazing requirements.

1.4 QUALITY ASSURANCE

A. Provide doors and frames complying with ANSI/SDI 100 "Recommended Specifications for Standard Steel Doors and Frames" and as specified.

B. Fire-Rated Door Assemblies: Units that comply with NFPA 80, are identical to door and frame assemblies tested for fire-test-response characteristics per ASTM E 152, and are labeled and listed by UL, Warnock Hersey, or another testing and inspecting agency acceptable to authorities having jurisdiction.
1. Temperature-Rise Rating: Where indicated, provide doors that have a temperature-rise rating of 450 deg F (250 deg C) maximum in 30 minutes of fire exposure.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver doors and frames cardboard-wrapped or crated to provide protection during transit and job storage. Provide additional protection to prevent damage to finish of factory-finished doors and frames.

B. Inspect doors and frames on delivery for damage. Minor damages may be repaired provided refinished items match new work and are acceptable to Architect; otherwise, remove and replace damaged items as directed.

C. Store doors and frames at building site under cover. Place units on minimum 4-inch- (100-mm-) high wood blocking. Avoid using nonvented plastic or canvas shelters that could create a humidity chamber. If cardboard wrappers on doors become wet, remove cartons immediately. Provide minimum 1/4-inch (6-mm) spaces between stacked doors to promote air circulation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Steel Doors and Frames:
      a. Ceco Door Products.
      b. Curries Co.
      c. Steelcraft.
      d. D & D
      e. Fleming
      f. Haberaham
      g. Republic Builders Products

2.2 MATERIALS

A. Hot-Rolled Steel Sheets and Strip: Commercial-quality carbon steel, pickled and oiled, complying with ASTM A 569 (ASTM A 569M).

B. Cold-Rolled Steel Sheets: Carbon steel complying with ASTM A 366 (ASTM A 366M), commercial quality, or ASTM A 620 (ASTM A 620M), drawing quality, special killed.

C. Galvanized Steel Sheets: Zinc-coated carbon steel complying with ASTM A 526 (ASTM A 526M), commercial quality, or ASTM A 642 (ASTM A 642M), drawing quality, hot-dip galvanized according to ASTM A 525, with A 60 or G 60 (ASTM A 525M, with Z 180 or ZF 180) coating designation, mill phosphatized.

D. Supports and Anchors: Fabricated from not less than 0.0478-inch- (1.2-mm-) thick steel sheet; 0.0516-inch- (1.3-mm-) thick galvanized steel where used with galvanized steel frames.

E. Inserts, Bolts, and Fasteners: Manufacturer's standard units. Where items are to be built into

exterior walls, hot-dip galvanize complying with ASTM A 153, Class C or D as applicable.

2.3 DOORS

A. Steel Doors: Provide 1-3/4-inch- (44-mm-) thick doors of materials and ANSI/SDI 100 grades and models specified below, or as indicated on Drawings or schedules:
   1. Interior Doors: Grade II, heavy-duty, Model 2, seamless design, minimum 0.0478-inch- (1.2-mm-) thick cold-rolled steel sheet faces.
   2. Exterior Doors: Grade II, heavy-duty, Model 2, seamless design, minimum 0.0516-inch- (1.3-mm-) thick galvanized steel sheet faces.

B. Door Louvers: Provide louvers according to SDI 111C for interior doors where indicated, with blades or baffles formed of 0.0239-inch- (0.6-mm-) thick cold-rolled steel sheet set into minimum 0.0359-inch- (0.9-mm-) thick steel frame.
   1. Sight-Proof Louvers: Stationary louvers constructed with inverted V-shaped or Y-shaped blades.

2.4 FRAMES

A. Provide metal frames for doors, transoms, sidelights, borrowed lights, and other openings, according to ANSI/SDI 100, and of types and styles as shown on Drawings and schedules. Conceal fastenings, unless otherwise indicated. Fabricate frames as follows:
   1. Fabricate frames with mitered or coped and continuously welded corners.
   2. Fabricate frames for interior openings of 16 Gage steel sheet.
   3. Form exterior frames from 14 Gage galvanized steel sheet.

B. Door Silencers: Except on weather stripped frames, drill stops to receive 3 silencers on strike jambs of single-door frames and 2 silencers on heads of double-door frames.

C. Plaster Guards: Provide minimum 0.0179-inch- (0.45-mm-) thick steel plaster guards or mortar boxes at back of hardware cutouts where mortar or other materials might obstruct hardware operation and to close off interior of openings.

D. Grout: When required in masonry construction, as specified in Division 4 Section "Unit Masonry Assemblies."

2.5 FABRICATION

A. Fabricate steel door and frame units to be rigid, neat in appearance, and free from defects, warp, or buckle. Where practical, fit and assemble units in manufacturer's plant. Clearly identify work that cannot be permanently factory assembled before shipment, to assure proper assembly at Project site. Comply with ANSI/SDI 100 requirements.

   1. Core Construction: Manufacturer’s standard Kraft-paper honeycomb, polystyrene, polyurethane, polyisocyanurate, mineral-board or vertical steel stiffener core.
   2. Clearances: Not more than 1/8 inch (3.2 mm) at jambs and heads, except not more than 1/4 inch (6.4 mm) between non-fire-rated pairs of doors. Not more than 3/4 inch (19 mm) at bottom.
      a. Fire Doors: Provide clearances according to NFPA 80.

B. Fabricate exposed faces of doors and panels, including stiles and rails of nonflush units, from only

cold-rolled steel sheet.

C. Tolerances: Comply with SDI 117 "Manufacturing Tolerances Standard Steel Doors and Frames."

D. Fabricate concealed stiffeners, reinforcement, edge channels, louvers, and moldings from either cold- or hot-rolled steel sheet.

E. Galvanized Steel Doors, Panels, and Frames: For the following locations, fabricate doors, panels, and frames from galvanized steel sheet according to SDI 112. Close top and bottom edges of doors flush as an integral part of door construction or by addition of minimum 0.0635-inch- (1.6-mm-) thick galvanized steel channels, with channel webs placed even with top and bottom edges. Seal joints in top edges of doors against water penetration.
1. At exterior locations.

F. Exposed Fasteners: Unless otherwise indicated, provide countersunk flat or oval heads for exposed screws and bolts.

G. Thermal-Rated (Insulating) Assemblies: At exterior locations and elsewhere as shown or scheduled, provide doors fabricated as thermal-insulating door and frame assemblies and tested according to ASTM C 236 or ASTM C 976 on fully operable door assemblies.
1. Unless otherwise indicated, provide thermal-rated assemblies with U-value rating of 0.41 Btu/sq. ft. x h x deg F (2.33 W/sq. m x K) or better.

H. Hardware Preparation: Prepare doors and frames to receive mortised and concealed hardware according to final door hardware schedule and templates provided by hardware supplier. Comply with applicable requirements of SDI 107 and ANSI A115 Series specifications for door and frame preparation for hardware.
1. For concealed overhead door closers, provide space, cutouts, reinforcing, and provisions for fastening in top rail of doors or head of frames, as applicable.

I. Reinforce doors and frames to receive surface-applied hardware. Drilling and tapping for surface-applied hardware may be done at Project site.

J. Locate hardware as indicated on Shop Drawings or, if not indicated, according to the Door and Hardware Institute's (DHI) "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."

K. Glazing Stops: Minimum 0.0359-inch- (0.9-mm-) thick steel or 0.040-inch- (1-mm-) thick aluminum.
1. Provide non-removable stops on outside of exterior doors and on secure side of interior doors for glass, louvers, and other panels in doors.
2. Provide screw-applied, removable, glazing beads on inside of glass, louvers, and other panels in doors.

2.6 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual" for recommendations relative to applying and designating finishes.

B. Comply with SSPC-PA 1, "Paint Application Specification No. 1," for steel sheet finishes.

C. Apply primers and organic finishes to doors and frames after fabrication.

2.7 GALVANIZED STEEL SHEET FINISHES

A. Surface Preparation: Clean surfaces with nonpetroleum solvent so that surfaces are free of oil or other contaminants. After cleaning, apply a conversion coating of the type suited to the organic coating applied over it. Clean welds, mechanical connections, and abraded areas, and apply galvanizing repair paint specified below to comply with ASTM A 780.
   1. Galvanizing Repair Paint: High-zinc-dust-content paint for re-galvanizing welds in galvanized steel, with dry film containing not less than 94 percent zinc dust by weight, and complying with DOD-P-21035 or SSPC-Paint 20.

B. Factory Priming for Field-Painted Finish: Where field painting after installation is indicated, apply air-dried primer specified below immediately after cleaning and pretreatment.
   1. Shop Primer: Zinc-dust, zinc-oxide primer paint complying with performance requirements of FS TT-P-641, Type II.

2.8 STEEL SHEET FINISHES

A. Surface Preparation: Solvent-clean surfaces to comply with SSPC-SP 1 to remove dirt, oil, grease, and other contaminants that could impair paint bond. Remove mill scale and rust, if present, from uncoated steel to comply with SSPC-SP 5 (White Metal Blast Cleaning) or SSPC-SP 8 (Pickling).

B. Pretreatment: Immediately after surface preparation, apply a conversion coating of type suited to organic coating applied over it.

C. Factory Priming for Field-Painted Finish: Apply shop primer that complies with ANSI A224.1 acceptance criteria, is compatible with finish paint systems indicated, and has capability to provide a sound foundation for field-applied topcoats. Apply primer immediately after surface preparation and pretreatment.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Install steel doors, frames, and accessories according to Shop Drawings, manufacturer's data, and as specified.

B. Placing Frames: Comply with provisions of SDI 105, unless otherwise indicated. Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is completed, remove temporary braces and spreaders, leaving surfaces smooth and undamaged.
   1. In masonry construction, install at least 3 wall anchors per jamb adjacent to hinge location on hinge jamb and at corresponding heights on strike jamb. Acceptable anchors include masonry wire anchors and masonry T-shaped anchors.
   2. Install fire-rated frames according to NFPA 80.

C. Door Installation: Fit hollow-metal doors accurately in frames, within clearances specified in ANSI/SDI 100.

1. Fire-Rated Doors: Install with clearances specified in NFPA 80.

3.2 ADJUSTING AND CLEANING

A. Prime Coat Touchup: Immediately after erection, sand smooth any rusted or damaged areas of prime coat and apply touchup of compatible air-drying primer.

B. Protection Removal: Immediately before final inspection, remove protective wrappings from doors and frames.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including the General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:
1. Solid core doors with wood veneer faces.
2. Factory finishing of flush wood doors.

B. Related Sections: The following Sections contain requirements that relate to this Section:
1. Division 6 Section "Finish Carpentry" for wood door frames.

1.3 SUBMITTALS

A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.

B. Product data for each type of door, including details of core and edge construction, trim for openings and louvers, and factory-finishing specifications.

C. Shop drawings indicating location and size of each door, elevation of each kind of door, details of construction, location and extent of hardware blocking, fire ratings, requirements for veneer matching and factory finishing and other pertinent data.
1. For factory-machined doors, indicate dimensions and locations of cutouts for locksets and other cutouts adjacent to light and louver openings.

D. Samples for initial selection in the form of color charts consisting of actual materials in small sections for the following:
1. Faces of factory-finished doors with transparent finish. Show the full range of colors available for stained finishes.
2. Faces of factory-finished doors with opaque finish. Show the full range of colors available.

E. Samples for verification in the form and size indicated below:
1. Corner sections of doors approximately 12 inches (300 mm) square with door faces and edgings representing the typical range of color and grain for each species of veneer and solid lumber required. Finish sample with same materials proposed for factory-finished doors.

1.4 QUALITY ASSURANCE

A. Quality Standard: Comply with the following standard:
1. NWWDA Quality Standard: I.S.1-A, "Architectural Wood Flush Doors," of the National Wood Window and Door Association.
2. AWI Quality Standard: "Architectural Woodwork Quality Standards" of the Architectural Woodwork Institute for grade of door, core, construction, finish, and other requirements.
3. WIC Quality Standard: "Manual of Millwork" of the Woodwork Institute of California for grade of door, core, construction, finish, and other requirements.

a. Provide WIC Certified Compliance Certificate indicating that doors meet requirements of grades specified.
b. Provide WIC Certified Compliance Certificate for installation.

B. Fire-Rated Wood Doors: Provide wood doors that comply with NFPA 80; are identical in materials and construction to units tested in door and frame assemblies per ASTM E 152; and are labeled and listed by UL, Warnock Hersey, or another testing and inspection agency acceptable to authorities having jurisdiction.

C. Single-Source Responsibility: Obtain doors from one source and by a single manufacturer.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Protect doors during transit, storage, and handling to prevent damage, soiling, and deterioration. Comply with requirements of referenced standard and manufacturer's instructions.
1. Comply with WIC Technical Bulletin 420-R for delivery, storage, and handling of doors.

B. Identify each door with individual opening numbers as designated on shop drawings, using temporary, removable, or concealed markings.

1.6 PROJECT CONDITIONS

A. Conditioning: Do not deliver or install doors until building is enclosed, wet work is complete, and HVAC system is operating and will maintain temperature and relative humidity at occupancy levels during the remainder of the construction period.

1.7 WARRANTY

A. General Warranty: Door manufacturer's warranty specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.

B. Door Manufacturer's Warranty: Submit written agreement on door manufacturer's standard form signed by manufacturer, Installer, and Contractor, agreeing to repair or replace defective doors that have warped (bow, cup, or twist) more than 1/4 inch (6.35 mm) in a 42-by-84-inch (1067-by-2134-mm) section or that show telegraphing of core construction in face veneers exceeding 0.01 inch in a 3-inch (0.25 mm in a 75-mm) span, or do not conform to tolerance limitations of referenced quality standards.
1. Warranty shall also include installation and finishing that may be required due to repair or replacement of defective doors where defect was not apparent prior to hanging.
2. Warranty shall be in effect during the following period of time after date of Substantial Completion.
a. Solid Core Interior Doors: Life of installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering doors

that may be incorporated in the Work include, but are not limited to, the following:

B. Manufacturer: Subject to compliance with requirements, provide doors by one of the following:
   1. Solid Core Doors:
      a. Algoma Hardwoods Inc.
      b. Buell Door Co.
      c. Eggers Industries, Architectural Door Division.
      d. Fenestra Corporation.
      e. Mohawk Flush Doors, Inc.
      f. Weyerhauser Co.
      g. Chappell Door
      h. VT Industries

2.2 INTERIOR FLUSH WOOD DOORS

A. Solid Core Doors for Transparent Finish: Comply with the following requirements:
   1. Faces: White birch, plain sliced.
   2. Grade: Premium.
   3. Construction: 5 plies.
   4. Core: Structural Composite lumber core as required to meet WDMA I.S.10.
   5. Bonding: Stiles and rails bonded to core, then entire unit abrasive planed before veneering.

B. Fire-Rated Solid Core Doors: Comply with the following requirements:
   1. Faces and Grade: Provide faces and grade to match non-fire-rated doors in same area of building, unless otherwise indicated.
   2. Construction: Manufacturer's standard core construction as required to provide fire-resistance rating indicated.
   3. Blocking: Provide composite blocking designed to maintain fire resistance of door butt with improved screw-holding capability of same thickness as core and with minimum dimensions as follows:
      a. 5-inch (125-mm) top rail blocking.
      b. 5-inch (125-mm) bottom rail blocking.
      c. 5-by-18-inch (125-by-450-mm) lock blocks.
      d. 5-inch (125-mm) midrail blocking.
   4. Edge Construction: Provide manufacturer's standard laminated-edge construction for improved screw-holding capability and split resistance as compared to edges composed of a single layer of treated lumber.

2.3 FABRICATION

A. Fabricate flush wood doors to comply with following requirements:
   1. In sizes indicated for job-site fitting.
   2. Factory fit doors to suit frame-opening sizes indicated, with the following uniform clearances and bevels:
      a. Comply with clearance requirements of referenced quality standard for fitting. Comply with requirements of NFPA 80 for fire-resistance-rated doors.
   3. Factory machine doors for hardware that is not surface applied. Locate hardware to comply with DHI-WDHS-3. Comply with final hardware schedules, door frame shop drawings, DHI A115-W series standards, and hardware templates.
      a. Coordinate measurements of hardware mortises in metal frames to verify dimensions and alignment before proceeding with factory machining.

b. Metal Astragals: Premachine astragals and formed-steel edges for hardware for pairs of fire-rated doors.

B. Openings: Cut and trim openings through doors to comply with applicable requirements of referenced standards for kind(s) of door(s) required.
1. Light Openings: Trim openings with moldings of material and profile indicated.
2. Louvers: Factory install louvers in prepared openings.

2.4 FACTORY FINISHING

A. General: Comply with referenced quality standard's requirements for factory finishing.

B. Finish wood doors at factory.

C. Transparent Finish: Comply with requirements indicated for grade, finish system, staining effect, and sheen.
1. Grade: Premium.
2. Finish: AWI System TR-6 catalyzed polyurethane.
3. Effect: Filled finish.
4. Sheen: Satin.
5. Stain: Color to be selected by Architect

PART 3-EXECUTION

3.1 EXAMINATION

A. Examine installed door frames prior to hanging door:
1. Verify that frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with plumb jambs and level heads.
2. Reject doors with defects.

B. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Hardware: For installation see Division 8 Section "Door Hardware."

B. Manufacturer's Instructions: Install wood doors to comply with manufacturer's instructions and referenced quality standard and as indicated.
1. Install fire-rated doors in corresponding fire-rated frames according to requirements of NFPA 80.

C. Job-Fit Doors: Align and fit doors in frames with uniform clearances and bevels as indicated below; do not trim stiles and rails in excess of limits set by manufacturer or permitted with fire-rated doors. Machine doors for hardware. Seal cut surfaces after fitting and machining.
1. Fitting Clearances for Non-Fire-Rated Doors: Provide 1/8 inch (3.2 mm) at jambs and heads, 1/16 inch (1.6 mm) per leaf at meeting stiles for pairs of doors, and 1/8 inch (3.2 mm) from bottom of door to top of decorative floor finish or covering. Where threshold is shown or scheduled, provide 1/4-inch (6.4-mm) clearance from bottom of door to top of threshold.

2. Fitting Clearances for Fire-Rated Doors: Comply with NFPA 80.
3. Bevel non-fire-rated doors 1/8 inch in 2 inches (3-1/2 degrees) at lock and hinge edges.
4. Bevel fire-rated doors 1/8 inch in 2 inches (3-1/2 degrees) on lock edge; trim stiles and rails only to extent permitted by labeling agency.

D. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.

E. Factory-Finished Doors: Restore finish before installation, if fitting or machining is required at the job site.

3.3 ADJUSTING AND PROTECTION

A. Operation: Rehang or replace doors that do not swing or operate freely.

B. Finished Doors: Refinish or replace doors damaged during installation.

C. Protect doors as recommended by door manufacturer to ensure that wood doors will be without damage or deterioration at the time of Substantial Completion.

END OF SECTION

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Special Conditions apply to this Section.

1.2 SUMMARY

A. This section includes, but is not limited to:

B. Access door and frame units.

1.3 RELATED SECTIONS

A. Section 09900 - Painting and Coating: Field paint finish.

1.4 SUBMITTALS

A. Product Data: Provide sizes, types, finishes, hardware, scheduled locations, and details of adjoining work.

B. Shop Drawings: Indicate exact position of all access door units.

C. Samples: Submit two access units, 12 x 12 inch (305 x 305 mm) in size illustrating hardware, frame configuration, anchors, and door configuration.

D. Manufacturer's Installation Instructions: Indicate installation requirements.

E. Project Record Documents: Record actual locations of all access units.

PART 2 PRODUCTS

2.1 ACCESS DOORS AND PANELS

A. All Units: Factory fabricated, fully assembled units with corner joints welded, filled, and ground flush; square and without rack or warp; coordinate requirements with assemblies units are to be installed in.

2.2 WALL UNITS

A. Door and Frame Units: Formed steel.

1. Frames and flanges: 0.058 inch (1.5 mm) steel.

2. Door panels: 0.070 inch (1.8 mm) single thickness steel sheet.

3. Sizes:
   a. Walls: 24 x 24 inches (300 x 300 mm), unless noted otherwise.

4. Hardware:
   a. Hinge: 175 degree stainless steel piano hinge with removable pin.
   b. Lock: Screw driver slot for quarter turn cam lock.

5. Galvanized, hot dipped finish.

2.3 FABRICATION

A. Weld, fill, and grind joints to ensure flush and square unit.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that rough openings are correctly sized and located.

3.2 INSTALLATION

A. Install units in accordance with manufacturer's instructions.

B. Install frames plumb and level in openings. Secure rigidly in place.

C. Position units to provide convenient access to the concealed work requiring access.

END OF SECTION

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes: Manual, automatic closing, overhead rolling fire doors.
B. Related Sections:
   1. 05500 Metal Fabrications.
   2. 06100 Rough Carpentry.
   3. 09900 Painting.
   4. Division 16.

1.2 SYSTEM DESCRIPTION

A. Performance Requirements:
   1. Provide doors with Underwriters' Laboratories, Inc. label for the fire rating classification, 1 1/2 hr.

1.3 SUBMITTALS

A. Reference Section 01330 Submittal Procedures; submit the following items:
   1. Product Data
   2. Shop Drawings: Include special conditions not detailed in Product Data. Show interface with adjacent work.
   3. Quality Assurance/Control Submittals:
      a. Provide manufacturer ISO 9001:2015 registration.
      b. Provide manufacturer and installer qualifications - see 1.4 below.
      c. Provide manufacturer's installation instructions.
   4. Closeout Submittals:
      a. Operation and Maintenance Manual.
      b. Certificate stating that installed materials comply with this specification.

1.4 QUALITY ASSURANCE

A. Qualifications:
   1. Manufacturer Qualifications: ISO 9001:2015 registered and a minimum of five years experience in producing fire and smoke control units of the type specified.
   2. Installer Qualifications: Manufacturer's approval.

1.5 DELIVERY STORAGE AND HANDLING

A. Reference Section 01600 Product Requirements.
B. Follow manufacturer's instructions.

1.6 WARRANTY

A. Standard Warranty: Two years from date of shipment against defects in material and workmanship.
B. Maintenance: Submit for owner’s consideration and acceptance of a maintenance service agreement for installed products.

PART 2 PRODUCTS

2.1 MANUFACTURER

A. Manufacturer:

1. Cornell: 24 Elmwood Avenue, Mountain Top, PA 18707. Telephone: (800) 233-8366.
2. Cookson
3. Clopay

Substitutions: Not permitted.

2.2 PRODUCT INFO

A. Model: ERD10

2.3 MATERIALS

A. Curtain:
   1. Slats: No. 5F
      a. Galvanized Steel with Finish as Described Below: No. 5F, minimum 18 gauge, Grade 40 steel, ASTM A 653 galvanized steel zinc coating
      a. Stainless Steel: No. 5F, 20 gauge AISI type 304 stainless steel
   2. Finish:
      a. Stainless Steel: #4 type 304 finish

         1) Vinyl Decal Graphics: Flat face surface of door curtain slats to include factory applied 4 -color process, 2 mil thick vinyl graphic image, 3M® or equal. Graphic image to be selected and electronically supplied by customer.

B. Endlocks:
Fabricate interlocking continuous slat sections with high strength steel endlocks secured with two ¼" (6.35 mm) rivets per UL requirements.

C. Bottom Bar:
   1. Configuration:
      a. Stainless Steel Angles: 2 AISI 300 series stainless steel angles minimum 2"x2"x1/8" (50x50x3.2 mm)
   2. Finish:
      a. Stainless Steel: #4 type 304 finish

D. Guides:
   1. Fabrication
      a. Minimum 3/16 inch (4.76 mm) stainless steel angles. Top of inner and outer guide angles to be flared outwards to form bellmouth for smooth entry of curtain into guides. Provide removable guide stoppers to prevent over travel of curtain and bottom bar. Top 16 ½" (419.10 mm) of coil side guide angles to be removable for ease of curtain installation and as needed for future curtain service.
   2. Finish:
      a. Stainless Steel: #4 type 304 finish

E. Counterbalance Shaft Assembly:
   1. Barrel: Steel pipe capable of supporting curtain load with maximum deflection of 0.03 inches per foot (2.5 mm per meter) of width
   2. Spring Balance: Oil-tempered, heat-treated steel helical torsion spring assembly designed for proper balance of door to ensure that maximum effort to operate will

not exceed 25 lbs (110 N). Provide wheel for applying and adjusting spring torque.

F. Brackets: Fabricate from minimum 1/4 inch (6.35 mm) steel plate with permanently lubricated ball or roller bearings at rotating support points to support counterbalance shaft assembly and form end closures
   1. Finish:
      a. Powder Coat (Color Selected by Architect): Zirconium treatment followed by baked-on polyester powder coat, color as selected by Architect from manufacturer's standard color range; minimum 2.5 mils (0.065 mm) cured film thickness; ASTM D-3363 pencil hardness: H or better

G. Hood:
Minimum 24 gauge stainless steel with reinforced top and bottom edges. Provide minimum 1/4 inch (6.35 mm) steel intermediate support brackets
   a. Stainless steel: #4 type 304 finish

H. Combination Weather/Smoke Seals:
   1. Bottom Bar:
      a. Manually Operated Doors: Two, replaceable, UL listed, brush smoke seals
   2. Guides and Head: Replaceable, UL listed, brush smoke seals sealing against fascia side of curtain

2.4 OPERATION

A. Manual Operation:

   1. FireGard™ Series Manual Chain Operation: Thermally activated, manually operated system with planetary gear reduction and internal release mechanism.
      a. Provide an internal brake mechanism to hold the door at any position during normal door operation.
      b. Thermally activate automatic closure by melting of a fusible link.
      c. Control automatic closure speed with an internal, totally enclosed, variable rate centrifugal governor without the use of electrical pulsation, non-variable rate viscosity, oscillation type or other governing devices.
      d. Maintain automatic closure speed at an average of 12” (304mm) per second.
      e. Reset door system by reconnecting fusible links or by re-engaging a failsafe release device from floor level.
      f. Provide minimum #50 roller chain from operator output shaft to the door drive shaft.
      g. Install system only with manufacturer supplied or specified fasteners.
      h. Ensure that manual resetting of spring tension or mechanical components will not be required.
      i. Drop test and reset door system twice by all means of activation and comply fully with NFPA 80 Section 5.

B. Sensing/Smoke Seal Edge:
   1. Provide automatic reversing control by an automatic sensing switch within neoprene or rubber astragal extending full width of door bottom bar.

C. Electric Sensing Edge Device:
   1. Provide only a wireless sensing edge connection to motor operator.

2. Electric coiling cords or take-up reels are not allowed to connect bottom sensing edge to motor.

2.5 ACCESSORIES

A. Fire Emergency Annunciator:
1. ADA compliant horn/strobe fire emergency annunciator to give advanced warning that fire shutter is about to close, activating warning signal upon alarm.

B. Operator and Full Bracket Mechanism Cover:
1. Provide minimum 24 gauge stainless steel sheet metal cover to enclose exposed moving operating components at coil area of unit. Finish to match door hood

C. Floor Level Test Device: For FireGard™ Motor, Chain or Crank operator.
1. Provide assembly that allows activation and reset from floor level.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine substrates upon which work will be installed and verify conditions are in accordance with approved shop drawings.
B. Coordinate with responsible entity to perform corrective work on unsatisfactory substrates.
C. Commencement of work by installer is acceptance of substrate.

3.2 INSTALLATION

A. General: Install door and operating equipment with necessary hardware, anchors, inserts, hangers and supports.
B. Comply with NFPA 80and follow manufacturer's installation instructions.

3.3 ADJUSTING

A. Following completion of installation, including related work by others, lubricate, test, and adjust doors for ease of operation, free from warp, twist, or distortion.

3.4 FIELD QUALITY CONTROL

A. Site Test: Test doors for normal operation and automatic closing. Coordinate with authorities having jurisdiction to witness test and sign Drop Test Form.

3.5 CLEANING

A. Clean surfaces soiled by work as recommended by manufacturer.
B. Remove surplus materials and debris from the site.

3.6 DEMONSTRATION

A. Demonstrate proper operation, testing and reset procedures to Owner's Representative.
B. Instruct Owner's Representative in maintenance procedures.

END OF SECTION

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 overhead coiling metal doors.

B. Types of overhead coiling doors include the following:

1. Overhead service doors.
2. Insulated overhead doors.

C. Operation of overhead coiling doors include the following:

1. Manual operation.
2. Chain operation.

D. Provide complete operating door assemblies including door curtains, guides, counterbalance mechanism, hardware, operators, and installation accessories.

E. Factory Finish

1.3 SUBMITTALS

A. General: Submit the following according to Conditions of Contract and Division 1 Specification Sections.

B. Product data, roughing-in diagrams, and installation instructions for each type and size of overhead coiling door.

1. Provide operating instructions and maintenance information.
2. Provide information describing fire-release system including electrical rough-in instructions.

C. Shop drawings for special components and installations that are not dimensioned or detailed in manufacturer's data sheets.

1.4 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Furnish each overhead coiling door as a complete

unit produced by one manufacturer, including hardware, accessories, mounting and installation components.

1. Furnish overhead coiling door units by one manufacturer for entire Project.

B. Insert and Anchorages: Furnish inserts and anchoring devices that must be set in concrete or built into masonry to install units. Provide setting drawings, templates, instructions, and directions to install anchorage devices. Coordinate delivery with other work to avoid delay.

1. See concrete and masonry Sections of these specifications regarding installation of inserts and anchorage devices.

C. Wind Loading: Design and reinforce overhead coiling doors to withstand a 20-psf (950 Pa) (85-mph (135 km/hr)) wind-loading pressure.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include, but are not limited to, the following:

B. Manufacturer: Subject to compliance with requirements, provide products by one of the following:

1. Apton Rolling Doors, A Gichner Systems Group, Inc.
2. Atlas Roll-Lite Overhead Doors/Div. of MASCO.
3. Ceco/Windsor Door--Div. of the Ceco Corp.
4. The Cookson Co.
5. Cornell Iron Works Inc.
6. Dynamic Closures Corp.
7. Mahon Door Corp.
8. Overhead Door Corp.
9. Pacific Rolling Door Co.
10. Raynor Garage Door.
11. Southwestern Steel Rolling Door Co.
12. Wayne-Dalton Corp.
13. J. G. Wilson Corp.

2.2 DOOR CURTAIN MATERIALS AND CONSTRUCTION

A. Door Curtain: Fabricate overhead coiling door curtain of interlocking slats, designed to withstand required wind loading, in a continuous length for width of door without splices. Unless otherwise indicated, provide slats of material gage

recommended by door manufacturer for size and type of door required, and as follows:

1. Aluminum Door Curtain Slats: Furnish with standard mill finish.

    a. Furnish manufacturer's standard S-configuration slats.
    b. Furnish manufacturer's standard "flat-face" slats.

B. Bottom Bar: Consisting of two angles, each not less than 1-1/2 x 1-1/2 x 1/8 inch (38 x 38 x 3 mm) thick, either galvanized or stainless steel or aluminum extrusions to suit type of curtain slats.

    1. Provide a replaceable gasket of flexible vinyl or neoprene between angles as a weather seal and cushion bumper for manually operated doors, unless shown as an overlapping joint.

C. Curtain Jamb Guides: Fabricate curtain jamb guides of steel angles, or channels and angles with sufficient depth and strength to retain curtain loading. Build up units with minimum 3/16-inch (5-mm) thick steel sections, galvanized after fabrication. Slot bolt holes for track adjustment.

D. Secure continuous wall angle to wall framing with a minimum of 3/8-inch (10-mm) bolts at not more than 30 inches (750 mm) o.c., unless closer spacing recommended by door manufacturer. Extend wall angles above door opening head to support coil brackets, unless otherwise indicated. Place anchor bolts on exterior wall guides so they are concealed when door is in closed position. Provide removable stops on guides to prevent over-travel of curtain and a continuous bar for holding windlocks.

E. Weather Seals: Provide vinyl or neoprene weatherstripping for exterior exposed doors, except where otherwise indicated. At door heads, use 1/8-inch (3-mm) thick continuous sheet secured to inside of curtain coil hood. At door jambs, use 1/8-inch (3-mm) thick continuous strip secured to exterior side of jamb guide.

2.3 COUNTERBALANCING MECHANISM

A. General: Counterbalance doors by means of adjustable steel helical torsion spring, mounted around a steel shaft and in a spring barrel, and connected to door curtain with required barrel rings. Use grease-sealed bearings or self-lubricating graphite bearings for rotating members.

B. Counterbalance Barrel: Fabricate spring barrel of hot-formed structural-quality carbon steel, welded or seamless pipe, of sufficient diameter and wall thickness to support roll-up of curtain without distortion of slats and to limit barrel deflection to not more than 0.03 inch per foot (2.5 mm per meter) of span under full load.

C. Provide spring balance of one or more oil-tempered, heat-treated steel helical torsion springs. Size springs to counterbalance weight of curtain, with uniform

adjustment accessible from outside barrel. Provide cast steel barrel plugs to secure ends of springs to barrel and shaft.

D. Fabricate torsion rod for counterbalance shaft of cold-rolled steel in size required to hold fixed spring ends and carry torsional load.

E. Brackets: Provide mounting brackets of manufacturer's standard design, either cast iron or cold-rolled steel plate with bell mouth guide groove for curtain.

F. Hood: Form to entirely enclose coiled curtain and operating mechanism at opening head and act as weather seal. Contour to suit end brackets to which hood is attached. Roll and reinforce top and bottom edges for stiffness. Provide closed ends for surface-mounted hoods and any portion of between-jamb mounting projecting beyond wall face. Provide intermediate support brackets as required to prevent sag.

1. Fabricate aluminum hoods for aluminum doors of Alloy 3003 or 5052 aluminum sheet not less than 0.032-inch (0.8-mm) thick, mill finish.

2.4 FACTORY FINISH

A. General: Provide manufactures standard color for factory finish.

B. General: Shop-clean and -prime ferrous metal and galvanized surfaces, exposed and unexposed, except tightly joined and lubricated surfaces, with door manufacturer's standard rust-inhibitive primer. Use primer that is compatible with finish painting.

3.5 MANUAL DOOR OPERATORS

A. Provide manual operators except where electric door operators are indicated. When not shown, provide chain hoist operator unit.

B. Manual Push-Up Operation: Design counterbalance mechanism so that required lift or pull for door operation does not exceed 25 lb (110 N).

1. Provide galvanized steel lifting handle and slide bolt lock on inside bottom bar.

C. Chain Hoist Operator: Provide manual chain hoist operator consisting of endless steel hand chain, chain pocket wheel and guard, and geared reduction unit with a maximum 35-lb (155 N) pull for door operation. Furnish alloy steel hand chain with chain holder secured to operator guide.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Install door and operating equipment complete with necessary hardware, jamb and head mold strips, anchors, inserts, hangers, and equipment supports according to final shop drawings, manufacturer's instructions, and as specified.

1. Install fire-rated doors to comply with NFPA 80.

B. After completing installation, including work by other trades, lubricate, test, and adjust doors to operate easily, free from warp, twist, or distortion.

1. Test door closing when activated by smoke-detector fire-release system. Reset door-closing mechanism after successful test.

C. Train Owner's maintenance personnel on procedures and schedules related to door operation, servicing, preventive maintenance, and procedures for resetting closing devices after activation.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Exterior swinging Four-Fold metal doors with surface mounted tube frames.
   2. Operation of Four-Fold metal doors includes overhead mounted electro-mechanical operator(s) located on the interior side of the wall.

1.2 SUBMITTALS

A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.

B. Product Data for each type of product specified consisting of manufacturer's technical Product Data and installation instructions for each type of door required, including data substantiating that products comply with requirements.

C. Submittal Drawings showing fabrication and installation of Four-Fold metal doors including plans, elevations, sections, details of components, hardware, operating mechanism, and attachments to the other units of Work. Include wiring diagrams for coordination with electrical trade.

D. Reference list including (5) successful installations of this type of door within the past two (2) years.

1.3 SUBMITTALS

A. Doors shall be designed to withstand external or internal horizontal wind loads of 20 pounds minimum per square foot. The maximum allowable deflection shall not exceed 1/120 of the span. Fiber stresses in main members shall be limited to 27,000 pounds per square inch. Steel frames shall be designed in accordance with the AISC "Steel Construction Manual.

B. Door manufacturer shall have at least 10 years experience in manufacturing door type specified for emergency vehicle applications.

1.4 DELIVERY, STORAGE AND HANDLING

A. Transport, handle, store, and protect products in compliance with the requirements of Sections 01600 and manufacturer's recommendations.
   1. Store delivered materials and equipment in dry locations with adequate ventilation, free from dust and water, and so as to permit access for inspection and handling.
   2. Handle materials carefully to prevent damage.

1.5 WARRANTY

A. The door manufacturer shall provide a written standard limited warranty for material and workmanship.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Provide one of the following or equal products by other manufacturers approved in advance: Four-Fold industrial metal doors manufactured by:
   1. Door Engineering and Manufacturing (Basis of Design for products specified in part 2): 400 Cherry Street, Kasota, MN 56050, (800)-959-1352 Series: FF100-600 Four-Fold Doors with interior mounted operators.
   2. Richards-Wilcox Canada, Mississauga, Ontario, Canada. Slidetite Series: Four Sections Bi-Parting Interior Mount design to fold (Open) inside.

B. Substitutions: Submit per requirements of section 01631.

2.2 MATERIALS

A. Steel Tube: ASTM A513 and ASTM A500/A500M

B. Steel Sheet: Steel sheets of commercial quality, complying with ASTM A1011/A1011M hot rolled steel sheet.

C. Hardware: Manufacturer's standard components.

D. Fasteners: Zinc-coated steel.

2.3 FOUR-FOLD DOORS

A. Construction: Door framing shall be minimum 11-gauge structural steel tube with 14-gauge steel sheet on the exterior and interior faces. Sheeting shall be formed on the vertical edges with no visible welds on the interior or exterior panel faces. All frames and framing members shall be true to dimension and square in all directions, and no door shall be bowed, warped, or out of line, in the vertical or horizontal plane of the door opening by more than 1/8 inch in 20 feet. Exposed welds and welds which interfere with the installation of various parts shall be ground smooth and flush.

B. Angle Frame: Supply pre-hung tube frame system constructed of minimum L6x4x0.25, designed to anchor to masonry wall construction or weld to steel structure. All hinges, track supports and operator supports shall be factory attached.

C. Factory finish: Operator and operating hardware shall be powder coated manufacturer's standard gray. Panels, frame and all other hardware shall be finished as follows.
   1. All exposed steel shall be finished with manufacturer's standard epoxy primer and polyurethane top coat, PPG Spectracron or equal. Customer to select from Manufacturer's standard color chart or furnish color to match.

D. Operating Hardware: Hardware shall include guide tracks and brackets, trolleys, center guides, not less than three pairs of jamb and fold hinges per opening, and all bolts, nuts, fasteners, etc. necessary for complete installation and operation. Jamb hinges shall be dual shear and have two thrust bearings and two needle bearings. Jamb hinges shall be gusseted. Fold hinges shall be dual shear with two thrust bearings. Fold hinges shall be stainless steel. All bearings shall be completely concealed within the hinge barrel and include grease zerks. All hinge pins shall be minimum ¾" diameter hardened steel.

E. Weatherstripping: Material shall be adjustable and readily replaceable and provide a substantially weather-tight installation. Weatherstripping at center shall be 1/16" cloth inserted neoprene and include no exposed fasteners on the exterior face of the panel. Weatherstripping

at sill shall include two 1/16" cloth inserted neoprene sweeps with an aluminum retainer. The retainer shall be attached to the door with adhesive.

F. Perimeter Weatherstripping: Provide jamb and head weatherstipping of 1/16" cloth-inserted neoprene bulb (or closed cell neoprene).

G. Vision Panels: Provide 1" insulated vision panels or grilles of the size, shape and location as noted on the drawings.

2.4 OPERATOR

A. Each Four-Fold door shall be operated by an overhead mounted electro-mechanical drive unit designed for high cycle operation. Each Operator consists of an electric motor, gear reducer, and rotating drive arm. The door shall be operated with connecting rods attached to the rotating drive arm on the operator and to control arms attached to the jamb door section and to the door lintel. The connecting rods shall be positive drive, keeping the door under firm control at all times. The connecting rods shall be fitted with spherical bearings and control arms shall be equipped with oil impregnated bronze bearings on polished shafts.

B. Operator shall be instantly reversible, open and close rapidly and start and stop gradually. Operator shall be adjustable to allow door to fully clear the opening. Operator shall automatically lock the door in the closed position. Operator shall be equipped with disengaging mechanism to convert to free wheeling mode for manual operation.

C. Electric motor shall be of sufficient size to operate doors under normal operating conditions at no more than 75 percent of rated capacity. The motor shall be wound for three phase 208/230/480 VAC, 60 Hertz operation.

D. Electric Controls: Controls shall be furnished by the door manufacturer and shall be complete for each door, and built in accordance with the latest NEMA standards. Incoming electrical shall be: 208/230VAC 3-phase.
1. Controls Controls shall include a programmable logic controller with digital message display or LED indicators. Controller shall include programmable close timers and programmable inputs/outputs.
2. Motor starters shall be magnetic reversing, factory wired with overload and under voltage protection, and equipped with mechanical interlocks. All control components shall be enclosed in one enclosure with a wiring diagram placed on the inside of the cover
3. If incoming voltage is single phase, control panel shall include a variable frequency drive to convert voltage to 3-phase for the motor.
4. Enclosures shall be NEMA 4 with disconnect switch
5. Pushbuttons (interior) for each door shall have one (1) momentary pressure three-button push-button station marked "OPEN", "CLOSE" and "STOP". Push button enclosure shall be NEMA 4.
6. Limit switches shall be provided to stop the travel of the door in its fully open or fully closed position.
7. Safety edges: Provide electric safety edges on leading edge of all doors to reverse door upon contact with obstruction.
8. Photo eyes: Provide (1) interior, jamb mounted, thru-beam type photo eyes, NEMA 4 rated.
9. Presence Sensor: Provide (1) interior, overhead mounted, presence sensor.
10. Radio controls: Provide one (1) radio receiver and (1) single button remotes per door. Remotes to open and close doors with single button.

11. Timer Activation Loop Detectors (fire station applications): Provide “pulse on exit type” loop detector to activate auto close timer once loop has been activated and cleared, include hand/auto switch to deactivate timer. G.C. to coordinate installation of preformed loop with installer prior to exterior apron being poured.
12. Wiring: Door manufacturer shall supply controls and components only. Electrical contractor shall install controls and furnish and install conduits and wiring for jobsite power and control wiring.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install Four-Fold metal doors in strict accordance with the approved drawings by qualified door erection crews. All door openings shall be completely prepared by the general contractor prior to the installation of the doors. Permanent or temporary electric wiring shall be brought to the door opening before installation is started and shall be completed so as not to delay the inspection test.

B. Doors shall be set plumb, level, and square, and with all parts properly fastened and mounted. All moving parts shall be tested and adjusted and left in good operating condition.

3.2 ADJUSTING AND CLEANING

A. Inspection of the doors and a complete operating test will be made by the installer in the presence of the general contractor or architect as soon as the erection is complete. Any defects noted shall be corrected. After door approval in the above test, the general contractor must assume the responsibility for any damage or rough handling of the doors during construction until the building is turned over to the owner and final inspection is made.

B. Clean surfaces and repaint abraded or damaged finished surfaces to match factory-applied finish.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Aluminum doors, frames, and glazed lights.
2. Door hardware.
3. Aluminum glazed lights.

B. Related Sections:
1. Section 08710 - Finish Hardware: Coordinate cylinders, thresholds and other hardware.
2. Section 08800 - Glazing: Glass products.

1.2 REFERENCES

A. The publications listed below form a part of this specification to the extent referenced. Publications are referenced within the text by the basic designation only.

B. American Architectural Manufacturers Association (AAMA)
1. AAMA 611 - Voluntary Specifications for Anodized Architectural Aluminum.

C. ASTM International (ASTM):
1. ASTM A 123 - Zinc (Hot-Dip Galvanized) Coatings On Iron And Steel Products
2. ASTM E 283 - Standard Test Method For Determining Rate Of Air Leakage Through Exterior Windows, Curtain Walls, And Doors Under Specified Pressure Differences Across The Specimen
3. ASTM E 331 - Water Penetration Of Exterior Windows, Skylights, Doors, And Curtain Walls By Uniform Static Air Pressure Difference.

D. Americans with Disabilities Act of 1990: Accessibility Guidelines for Buildings and Facilities.

E. American National Standards Institute (ANSI):
1. ANSI A117.1 - Specifications for Making Buildings and Facilities Accessible to and Usable by Physically Handicapped People.

1.3 SYSTEMS DESCRIPTION

A. Storefront System Performance Requirements:
1. Air Infiltration: ASTM E 283. Air infiltration rate shall not exceed 0.06 cfm/ft2 at a static air pressure differential of 6.24 psf.
2. Water Penetration Under Static Pressure: Systems do not evidence water penetration through fixed glazing and framing areas when tested according to ASTM E 331 at a minimum static-air-pressure difference of 20 percent of positive wind-load design pressure, but not less than 6.24 lbs/sq. ft.
3. Structural Performance: Maximum deflection of L/175 of span under a windload pressure calculation by the manufacturer based on the design wind loads shown on the Structural Drawings but not less than 20 psf.

1.4 QUALITY ASSURANCE

A. Regulatory Requirements: Conform to disabled access requirements of the following:
1. State or Local requirements (where applicable).
2. ANSI A117.1.

3. ADA (Americans with Disabilities Act - 1990) requirements for entrance door access, entrance doors and hardware.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with requirements, products by one of the following manufacturers may be provided. Basis of Design per Kawneer system.
   1. Kawneer Company, Inc., Contacts as follows:
      a. Central Area: Franklin, IN, (877) 505-3757, FAX: (800) 755-4639.
      b. Eastern Area: Bloomsburg, PA, (877) 505-3756, FAX: (800) 786-4097.
      c. Southern Area: Springdale AR, (877) 505-3783, FAX: (800) 800-4789.
      d. Western Area: Visalia, CA, (877) 505-3785, FAX: (800) 759-2810.
   2. EFCO Corporation; Monett, MO; (800) 221-4169.
   3. Southwest Aluminum Systems, Inc.; Chandler, AZ; (602) 961-2000.
   4. Tubelite, Inc.; Reed City, MI; (800) 866-2227.
   5. U.S. Aluminum Corporation; Waxahachie, TX; (800) 627-6440.
   6. Vistawall Architectural Products; Terrell, TX; (800) 869-4567.

B. Substitutions: Not permitted.

2.2 FRAMING

A. Exterior Framing System: Basis of Design - TRIFAB 601T, by Kawneer. 2 x 6 inch nominal dimension, thermally broken extruded aluminum flush glazed framing system, unless noted otherwise on drawings.
   1. Thermal Barrier: Thermal break with a 1/4" separation consisting of a two part chemically curing, high density polyurethane which is mechanically and adhesively joined to aluminum storefront sections.

B. Interior Framing System: Basis of Design - TRIFAB VG 451, by Kawneer. 2 x 4-1/2 inch nominal dimension, extruded aluminum flush glazed framing system.

C. Receptor Channel: Basis of Design - Kawneer Model No. 451VG570 and 451VG572, or sizes as required per framing systems specified above.
   1. Finish: To match adjacent storefront system.

D. Member Wall Thickness: Each framing member shall provide structural strength to meet specified performance requirements.

2.3 DOORS

A. Doors: Series 350 swing door, medium stile, by Kawneer. Door sizes indicated on Drawings.
   1. Top Rail: 6-1/2 inch, single piece.
   2. Bottom Rail: 10 inch.
   3. Glazing: 1/4 inch thick units per Section 08800, with standard bevel glass stops.

2.4 HARDWARE

A. Closers:
   1. Single Acting Doors: Heavy duty, parallel arm only, surface closer meeting ADA-90 requirements, independently hung, with adjustable back check and 100 degree

hold-open; slim line half covers, spray painted aluminum to match aluminum storefront system. Attachment: Thru-bolted in door. No drop-plates allowed.
a. Dorma 7601PA Series.
b. LCN P1461.
c. Norton 8301BF.
d. Russwin 2820DA.
e. Yale 3301BF.

B. Pivots:
1. Off-set Pivots: For single acting doors.
2. Intermediate Pivots: For single acting doors, adjustable, load bearing, surface applied; to match door finish.

C. Push/Pulls: Type CP-2 push and type CO-9 pull, by Kawneer Company, Inc. Finish: #14 Clear Anodized. Mount push bar at 42 inches above finish floor.

D. Hinges: Continuous aluminum geared hinge, concealed leaf, heavy duty, finish to match door finish. Roton Model 780-112HD as manufactured by Hager or equivalent.

E. Door Holder (Exterior doors only): 1221-4 cast iron, finish to match door color, by Trimco - Triangle Brass Mfg. Co.

F. Weatherstripping (Exterior doors only):
1. Head and Jamb: Replaceable wool, polypropylene, or nylon wool pile with aluminum strip backing, recessed in frame.
2. Sill: Semi-rigid polymeric material on aluminum anodized to match door; EPDM sweep strip; 38-560 by Kawneer or similar by other named manufacturers.

G. Threshold: See Section 08710.

H. Hardware Schedule: Provide hardware as scheduled for each exterior entry/exit doors as required under this Section. Coordinate with hardware supplier and prepare door for field installation as required for additional hardware as specified in Section 08710.
1. Off-set pivot hinges, top and bottom
2. Intermediate Pivots
3. Closers
4. Weatherstripping
5. Threshold, coordinate with Section 08710
6. Push / Pull Sets
7. Deadbolt Locks, coordinate cylinder with Section 08710.

I. Additional Hardware: Coordinate with hardware supplier and prepare door as required for additional field installed hardware as specified in Section 08710.

2.5 FABRICATION

A. Fabricate components with minimum clearances and shim spacing around perimeter of assembly, yet enabling installation and dynamic movement of perimeter seal.

B. Rigidly fit and secure joints and corners. Make joints and connections flush, hairline, and weatherproof.

C. Develop drainage holes with moisture pattern to exterior.

D. Prepare components to receive anchor devices. Fabricate anchorage items. Arrange fasteners, attachments, and jointing to ensure concealment from view.

E. Prepare components with internal reinforcement for door hardware.

F. Reinforce framing members for imposed loads.

G. Accessories:
1. Break Metal Closures: Minimum 0.040 inch thick aluminum x length required. Finish shall match adjacent related work.
2. Provide clean sharp edges, uniform in appearance and consistent in shape. Secure in place with concealed fasteners where possible. Exposed fasteners shall match enclosure fabrication.
3. Sill Flashing: Fabricate to configuration indicated and required of minimum 0.040 inch aluminum having exposed edges hemmed. Finish shall match adjacent related work.

2.6 FINISHES

A. Comply with NAAMM "Metal Finishes Manual" for recommendations relative to applying and designating finishes.

B. Finish designations prefixed by AA conform to the system established by the Aluminum Association for designating aluminum finishes.

C. High-Performance Organic Coating Finish: AA-C12C42R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: acid chromate-fluoride-phosphate conversion coating; Organic Coating: as specified below). Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturer's instructions.
1. Fluoropolymer 3-Coat Coating System: Manufacturer's standard 3-coat, thermocured system composed of specially formulated inhibitive primer, fluoropolymer color coat, and clear fluoropolymer topcoat, with both color coat and clear topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight; complying with AAMA 605.2.
2. Color and Gloss: As selected by Architect from manufacturer's full range of choices for color and gloss.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify wall openings are ready to receive work of this Section. Verify dimensions, tolerances, and method of attachment with other work.

B. Beginning of installation means acceptance of existing conditions.

3.2 INSTALLATION

A. Install storefront system components in accordance with manufacturer's instructions.

B. Use anchorage devices to securely attach frame assembly to structure.

C. Align assembly plumb and level, free of warp or twist. Maintain assembly dimensional tolerances, aligning with adjacent work.

D. Break Metals:
1. Set sill flashing in full bed of sealant. Provide riveted end laps of not less than 3 inches.

E. Pack fibrous insulation in shim spaces at perimeter of assembly to maintain continuity of thermal barrier.

F. Install perimeter sealant and backing materials in accordance with Section 07901.

G. Install glass in accordance with Section 08800, to glazing method required to achieve performance criteria.

H. Install hardware using templates provided and in accordance with disabled access regulatory requirements for hardware. Refer to Section 08710 for cylinders and installation requirements.
1. Cylinder and Thumb Turn: 48 inches above finished floor.

I. Set thresholds in bed of mastic and secure.

J. Adjust operating hardware and crash bars for smooth operation.

3.3 TOLERANCES

A. Variation from Plane: 0.03 inches per foot maximum or 0.25 inches per 30 feet, whichever is less.

B. Misalignment of Two Adjoining Members Abutting in Plane: 0.015 inches.

3.4 FIELD QUALITY CONTROL

A. Inspect storefront system installation and attachment to building structure.

B. Inspect door operation and hardware installation.

3.5 CLEANING

A. Wash down exposed surfaces using a solution of mild detergent in warm water, applied with soft, clean wiping cloths. Take care to remove dirt from corners. Wipe surfaces clean.

B. Remove excess sealant by moderate use of mineral spirits or other solvent acceptable to sealant manufacturer.

END OF SECTION

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 Architectural Grade aluminum windows of the performance class indicated. Window types required include the following:
   1. Single-hung windows.

1.3 DEFINITIONS

A. Performance class number, included as part of the window designation system, is the actual design pressure in pounds force per square foot (pascals) used to determine structural test pressure and water test pressure.
   1. Structural test pressure, wind load test, is equivalent to 150 percent of the design pressure.
   2. Water-leakage-resistance test pressure is equivalent to 15 percent of the design pressure with 2.86 lbf/sq. ft. (137 Pa) as a minimum for Residential, Commercial, and Heavy-Commercial Grade windows.

1.4 PERFORMANCE REQUIREMENTS

A. General: Provide aluminum windows engineered, fabricated, and installed to withstand normal thermal movement, wind loading, and impact loading without failure, as demonstrated by testing manufacturer's standard window assemblies representing types, grades, classes, and sizes required for Project according to test methods indicated.

B. Test Criteria: Testing shall be performed by a qualified independent testing agency based on the following criteria:
   1. Design wind velocity at Project site is 70 mi./h (113 km/h).
   2. Test Procedures: Test window units according to ASTM E 283 for air infiltration, ASTM E 547 for water penetration, and ASTM E 330 for structural performance.

C. Performance Requirements: Testing shall demonstrate compliance with requirements indicated in AAMA 101 for air infiltration, water penetration, and structural performance for type, grade, and performance class of window units required. Where required design pressure exceeds the minimum for the specified window grade, comply with requirements of AAMA 101, Section 3, "Optional Performance Classes," for higher than minimum performance class.
   1. Air-Infiltration Rate for Fixed Windows: Not more than 0.15 cfm/ft. (2.74 cu. m/h per m) of area for an inward test pressure of 6.24 lbf/sq. ft. (299 Pa).
   2. Air-Infiltration Rate for Operating Units: Not more than 0.10 cfm/ft. (0.56 cu. m/h per m) of operable sash joint for an inward test pressure of 6.24 lbf/sq. ft. (299 Pa).
   3. Water Penetration: No water penetration as defined in the test method at an inward test pressure of 15 percent of the design pressure.
   4. Uniform Load Deflection: No deflection in excess of 1/175 of any member's span during the imposed load, for a positive (inward) and negative (outward) test pressure of 60 lbf/sq. ft. 5. Condensation Resistance: Where window units are indicated to be "thermally improved," provide units tested for thermal performance according to AAMA 1503.1 showing a condensation resistance factor (CRF) of 45.
   6. Thermal Transmittance: Provide window units with a U-value maximum of 0.69 Btu/sq. ft. x

h x deg F (3.9 W/sq. m x K) at 15-mi./h (24-km/h) exterior wind velocity, when tested according to AAMA 1503.1.

7. Thermal Movements: Provide window units that allow thermal movement resulting from the following maximum change (range) in ambient temperature when engineering, fabricating, and installing aluminum windows to prevent buckling, opening of joints, and overstressing of components, connections, and other detrimental effects. Base engineering calculation on actual surface temperatures of materials due to solar heat gain and nighttime sky heat loss.
   a. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.
8. Sound-Insulation Construction: Provide window units certified to provide a Sound Transmission Class (STC) rating of at least 40 when tested according to ASTM E 90 and classified according to ASTM E 413.

1.5 SUBMITTALS

A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.

B. Product Data for each type of window required, including the following:
   1. Construction details and fabrication methods.
   2. Profiles and dimensions of individual components.
   3. Data on hardware, accessories, and finishes.
   4. Recommendations for maintaining and cleaning exterior surfaces.

C. Shop Drawings showing fabrication and installation of each type of window required including information not fully detailed in manufacturer's standard Product Data and the following:
   1. Layout and installation details, including anchors.
   2. Elevations at 1/4 inch = 1 foot (1:50) scale and typical window unit elevations at 3/4 inch = 1 foot (1:20) scale.
   3. Full-size section details of typical composite members, including reinforcement and stiffeners.
   4. Location of weep holes.
   5. Panning details.
   6. Hardware, including operators.
   7. Window cleaning provisions.
   8. Glazing details.
   9. Accessories.

D. Samples for initial color selection on 12-inch- (300-mm-) long sections of window members. Where finishes involve normal color variations, include Sample sets showing the full range of variations expected.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced Installer who has completed installation of aluminum windows similar in material, design, and extent to those required for this Project and with a record of successful in-service performance.

B. Product Options: The Drawings indicate sizes, profiles, dimensional requirements, and aesthetic effects of aluminum windows and are based on the specific window types and models indicated. Other aluminum window manufacturers whose products have equal performance characteristics may be considered provided deviations in size, profile, and dimensions are minor and do not alter

the aesthetic effect. Refer to Division 1 Section "Substitutions."

1.7 PROJECT CONDITIONS

A. Field Measurements: Check window openings by field measurements before fabrication and show recorded measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
   1. Where field measurements cannot be made without delaying the Work, guarantee opening dimensions and proceed with fabricating aluminum windows without field measurements. Coordinate wall construction to ensure that actual opening dimensions correspond to guaranteed dimensions.

1.8 WARRANTY

A. General Warranty: The special warranty specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.

B. Special Warranty: Submit a written warranty signed by aluminum window manufacturer agreeing to repair or replace window components that fail in materials or workmanship within the specified warranty period. Failures include, but are not limited to, the following:
   1. Structural failures including excessive deflection, water leakage, air infiltration, or condensation.
   2. Faulty operation of sash and hardware.
   3. Deterioration of metals, metal finishes, and other materials beyond normal weathering.

C. Warranty Period: 3 years after date of Substantial Completion.

D. Warranty Period for Metal Finishes and Glass: 5 years after date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Double-Hung (Single-Hung and Triple-Hung) Windows:
      a. Acorn Window Systems.
      b. Alenco Commercial Division.
      c. Capitol Products Corp.
      d. Custom Window Company.
      e. EFCO Corporation.
      f. Graham Architectural Products Corporation.
      g. Peerless Products, Inc.
      h. TRACO.
   2. Fixed Windows:
      a. Acorn Window Systems.
      b. Alenco Commercial Division.
      c. Capitol Products Corp.
      d. Custom Window Company.
      e. EFCO Corporation.

f. Graham Architectural Products Corporation.
g. Peerless Products, Inc.
h. TRACO.

2.2 MATERIALS

A. Aluminum Extrusions: Provide alloy and temper recommended by manufacturer for strength, corrosion resistance, and application of required finish, but not less than 22,000-psi (150-MPa) ultimate tensile strength and not less than 0.062 inch (1.6 mm) thick at any location for main frame and sash members.

B. Fasteners: Provide aluminum, nonmagnetic stainless steel, epoxy adhesive, or other materials warranted by manufacturer to be noncorrosive and compatible with aluminum window members, trim, hardware, anchors, and other components of window units.
1. Reinforcement: Where fasteners screw anchor into aluminum less than 0.125 inch (3.2 mm) thick, reinforce interior with aluminum or nonmagnetic stainless steel to receive screw threads or provide standard, noncorrosive, pressed-in, splined grommet nuts.
2. Exposed Fasteners: Except where unavoidable for application of hardware, do not use exposed fasteners. For application of hardware, use fasteners that match finish of member or hardware being fastened, as appropriate.

C. Anchors, Clips, and Window Accessories: Fabricate anchors, clips, and window accessories of aluminum, nonmagnetic stainless steel, or hot-dip zinc-coated steel or iron complying with requirements of ASTM B 633; provide sufficient strength to withstand design pressure indicated.

D. Compression-Type Glazing Strips and Weatherstripping: Unless otherwise indicated, and at manufacturer's option, provide compressible stripping for glazing and weatherstripping such as molded EPDM or neoprene gaskets complying with ASTM D 2000 Designation 2BC415 to 3BC620, or molded PVC gaskets complying with ASTM D 2287, or molded expanded EPDM or neoprene gaskets complying with ASTM C 509, Grade 4.

E. Sealant: For sealants required within fabricated window units, provide type recommended by manufacturer for joint size and movement. Sealant shall remain permanently elastic, nonshrinking, and nonmigrating. Comply with Division 7 Section "Joint Sealants" of these Specifications for selection and installation of sealants.

2.3 HARDWARE

A. General: Provide manufacturer's standard hardware fabricated from aluminum, stainless steel, or other corrosion-resistant material compatible with aluminum and of sufficient strength to perform the function for which it is intended.

B. Counterbalancing Mechanism: Comply with AAMA 902.2. Provide one of the following:
1. Sash-Balance Type: Concealed block-and-tackle type of size and capacity to hold sash stationary at any open position.
2. Sash-Balance Type: Concealed-spiral type of size and capacity to hold sash stationary at any open position.
3. Sash-Balance Type: Concealed-tape-spring type of size and capacity to hold sash stationary at any open position.

2.4 ACCESSORIES

A. General: Provide manufacturer's standard accessories that comply with indicated standards.

B. Weatherstripping: Provide sliding-type weatherstripping where sash rails slide horizontally or vertically along unit frame. Provide compression-type weatherstripping at perimeter of each operating sash where sliding type is inappropriate.
   1. Provide weatherstripping locked into extruded grooves in sash.

2.5 DOUBLE-HUNG WINDOWS (SINGLE-HUNG)

A. Window Grade and Class: Comply with requirements of AAMA Grade and Performance Class DH-DW-HC40. Window units shall successfully pass operating force and deglazing test performance requirements specified in AAMA 101.

B. Window Grade and Class: Comply with requirements of AAMA Grade and Performance Class DH-AW40. Window units shall successfully pass operating force test performance requirements specified in AAMA 101 and life-cycle test requirements specified in AAMA 910.
   1. Provide window units with tilt-in feature permitting both sides of sash to be cleaned from interior.

C. Hardware: Provide the following equipment and operating hardware:
   1. Sash Balances: Manufacturer's standard type (2 per sash).
   2. Sash Lock: Cam-action sweep lock and keeper on meeting rail.
   3. Sash Lock: Pole-operated, cam-action locking device on meeting rail of windows with meeting rail more than 72 inches (1800 mm) above floor.
   4. Tilt Lock: Tamperproof, key-operated tilt mechanism to permit sash to tilt inward for cleaning.
   5. Lift Handle: Continuous, integral, sash lift bar on bottom rail of lower sash.
   6. Pull-Down Handles: Continuous, integral handle on bottom rail of lower sash.
   7. Pole Socket: Provide a pole socket or groove on inside face of top rail of upper sash on window units with meeting rails more than 72 inches (1800 mm) above floor.

2.6 FABRICATION

A. General: Fabricate aluminum window units to comply with indicated standards. Include a complete system for assembly of components and anchorage of window units.
   1. Provide units that are reglazable without dismantling sash or ventilator framing.
   2. Prepare window sash or ventilators for glazing, except where preglazing at the factory is indicated.

B. Thermally Improved Construction: Fabricate window units with an integral, concealed, low-conductance, thermal barrier, located between exterior materials and window members exposed on interior, in a manner that eliminates direct metal-to-metal contact.
   1. Provide thermal-break construction that has been in use for not less than 3 years, has been tested to demonstrate resistance to thermal conductance and condensation, and has been tested to show adequate strength and security of glass retention.
   2. Provide hardware with low conductivity or nonmetallic material for hardware bridging thermal breaks at frame or vent sash.
   3. Weep Holes: Provide weep holes and internal passages to conduct infiltrating water to exterior.
   4. Provide water-shed members above side-hinged ventilators and similar lines of natural water penetration.
   5. Subframes: Provide subframes with anchors for window units as shown, of profile and dimensions indicated but not less than 0.062-inch- (1.6-mm-) thick extruded aluminum. Miter or cope corners, and weld and dress smooth with concealed mechanical joint

fasteners. Finish to match window units.

6. Mullions: Provide mullions and cover plates as shown, matching window units, complete with anchors for support to structure and installation of window units. Allow for erection tolerances and provide for movement of window units due to thermal expansion and building deflections, as indicated.

C. Preglazed Fabrication: Preglaze window units at the factory where possible and practical for applications indicated. Comply with glass and glazing requirements of Division 8 Section "Glazing" of these Specifications and AAMA 101.

2.8 FIXED WINDOWS

A. Window Grade and Class: Comply with requirements of AAMA Grade and Performance Class DH-DW-HC40. Window units shall successfully pass operating force and deglazing test performance requirements specified in AAMA 101.

B. Window Grade and Class: Comply with requirements of AAMA Grade and Performance Class DH-AW40. Window units shall successfully pass operating force test performance requirements specified in AAMA 101 and life-cycle test requirements specified in AAMA 910.

C. Comply with requirements for fabrication as indicated above in Part 2.

2.9 FINISHES

A. Comply with NAAMM "Metal Finishes Manual" for recommendations relative to applying and designating finishes.

B. Finish designations prefixed by AA conform to the system established by the Aluminum Association for designating aluminum finishes.

C. High-Performance Organic Coating Finish: AA-C12C42R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: acid chromate-fluoride-phosphate conversion coating; Organic Coating: as specified below). Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturer's instructions.

1. Fluoropolymer 3-Coat Coating System: Manufacturer's standard 3-coat, thermocured system composed of specially formulated inhibitive primer, fluoropolymer color coat, and clear fluoropolymer topcoat, with both color coat and clear topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight; complying with AAMA 605.2.
2. Color and Gloss: As selected by Architect from manufacturer's full range of choices for color and gloss.

PART 3 - EXECUTION

3.1 INSPECTION

A. Inspect openings before installation. Verify that rough or masonry opening is correct and sill plate is level.

1. Masonry surfaces shall be visibly dry and free of excess mortar, sand, and other construction debris.
2. Wood frame walls shall be dry, clean, sound, well nailed, free of voids, and without offsets at joints. Ensure nail heads are driven flush with surfaces in opening and within 3 inches

(75 mm) of opening.

3. Metal surfaces shall be dry; clean; free of grease, oil, dirt, rust and corrosion, and welding slag; without sharp edges or offsets at joints.

3.2 INSTALLATION

A. Comply with manufacturer's specifications and recommendations for installing window units, hardware, operators, and other components of the Work.

B. Set window units plumb, level, and true to line, without warp or rack of frames or sash. Provide proper support and anchor securely in place.
   1. Separate aluminum and other corrodible surfaces from sources of corrosion or electrolytic action at points of contact with other materials by complying with requirements specified under "Dissimilar Materials" Paragraph in appendix to AAMA 101.

C. Set sill members and other members in a bed of sealant or with joint fillers or gaskets, as shown on Shop Drawings, to provide weathertight construction. Refer to Division 7 Section "Joint Sealants" for compounds, fillers, and gaskets to be installed concurrently with window units. Coordinate installation with wall flashings and other components of the Work.
   1. Sealants, joint fillers, and gaskets to be installed after installation of window units are specified in another Division 7 Section.

3.3 ADJUSTING

A. Adjust operating sash and hardware to provide a tight fit at contact points and at weatherstripping for smooth operation and a weathertight closure.

3.4 CLEANING

A. Clean aluminum surfaces promptly after installing windows. Exercise care to avoid damage to protective coatings and finishes. Remove excess glazing and sealant compounds, dirt, and other substances. Lubricate hardware and other moving parts.

B. Clean glass of preglazed units promptly after installing windows. Comply with requirements of Division 8 Section "Glazing" for cleaning and maintenance.

3.5 PROTECTION

A. Provide final protection and maintain conditions, in a manner acceptable to aluminum window manufacturer, that ensure window units are without damage or deterioration at the time of Substantial Completion.

END OF SECTION

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. Commercial door hardware for the following:

a. Swinging doors.

B. Related Sections include the following:

1. Section 08110 - Steel Doors and Frames: for door silencers provided as part of the frame.
2. Section 08211 - Flush Wood Doors.

C. Products furnished, but not installed, under this Section include the following. Coordinating, purchasing, delivering, and scheduling remain requirements of this Section.
1. Final replacement cores and keys to be installed by Owner.

1.3 SUBMITTALS

A. Product Data: Include installation details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Samples for Initial Selection: Manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available for each type of door hardware indicated.

C. Samples: For exposed door hardware of each type indicated below, in specified finish, full size. Tag with full description for coordination with the Door Hardware Schedule. Submit samples before, or concurrent with, submission of the final Door Hardware Schedule.

1. Door Hardware: As follows:

a. Hinges.
b. Locks and latches.
c. Bolts.
d. Exit devices.
e. Cylinders and keys.
f. Operating trim.
g. Closers.

h. Stops and holders.
i. Protective trim.
j. Door gasketing.
k. Thresholds.
l. KeyScan Card Reader (see Door Schedule for locations)

2. Samples will be returned to Contractor. Units that are acceptable and remain undamaged through submittal, review, and field comparison process may, after final check of operation, be incorporated into the Work, within limitations of keying requirements.

D. 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.

a. Organize door hardware sets in same order as in the Door Hardware Schedule at the end of Part 3.

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 each 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 initial draft of final schedule along with essential Product Data to facilitate the fabrication of other work that is critical in the Project construction schedule. Submit the final Door Hardware Schedule after Samples, Product Data,

5. Coordination with Shop Drawings of other work, delivery schedules, and similar information has been completed and accepted.

E. Keying Schedule: Prepared by or under the supervision of supplier, detailing Owner's final keying instructions for locks. Include schematic keying diagram and index each key set to unique door designations.

F. Qualification Data: For firms and persons specified in "Quality Assurance" Article.

G. Maintenance Data: For each type of door hardware to include in maintenance manuals specified in Division 1.

H. Warranties: Special warranties specified in this Section. Coordinate with Warranties of Division 1..

1.4 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who has completed door hardware similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.

B. Supplier Qualifications: Door hardware supplier with warehousing facilities in Project's vicinity and who is or employs a qualified Architectural Hardware Consultant, available during the course of the Work to consult with Contractor, Architect, and Owner about door hardware and keying.

1. Scheduling Responsibility: Preparation of door hardware and keying schedules.

C. Regulatory Requirements: Comply with provisions of 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, FED-STD-795, "Uniform Federal Accessibility Standards," 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 (22.2 N) applied perpendicular to door.
2) Fire Doors: Minimum opening force allowable by authorities having jurisdiction.

c. Thresholds: Not more than 1/2 inch (13 mm) 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 (67 N) to release the latch. Locks shall not require the use of a key, tool, or special knowledge for operation.
b. Door Closers: Not more than 30 lbf (133 N) to set door in motion and not more than 15 lbf (67 N) to open door to minimum required width.
c. Thresholds: Not more than 1/2 inch (13 mm) high.

D. Fire-Rated Door Assemblies: Provide door hardware for assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to NFPA 252.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Inventory door hardware on receipt and provide secure lock-up for door hardware delivered to Project site.

B. Tag each item or package separately with identification related to the final Door Hardware Schedule, and include basic installation instructions with each item or package.

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 door hardware. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.

1.7 WARRANTY

A. General Warranty: 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. Special Warranty: Written warranty, executed by manufacturer agreeing to repair or replace components of door hardware that fail in materials or workmanship within specified warranty period. Failures include, but are not limited to, the following:

1. Structural failures including excessive deflection, cracking, or breakage.
2. Faulty operation of operators and door hardware.
3. Deterioration of metals, metal finishes, and other materials beyond normal weathering.

C. Warranty Period: Three years from date of Substantial Completion, unless otherwise indicated.

D. Warranty Period for Manual Closers: 10 years from date of Substantial Completion.

1.8 MAINTENANCE SERVICE

A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.

PART 2 - PRODUCTS

2.1 HINGES AND PIVOTS, GENERAL

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. Hinges:

a. Baldwin Hardware Corporation.
b. Bommer Industries, Inc.
c. Hager Companies.

d. McKinney Products Company; Div. of ESSEX Industries, Inc.
e. Sargent Manufacturing Company; Div. of ESSEX Industries, Inc.

B. Standards: Comply with the following:

1. Butts and Hinges: BHMA A156.1.
2. Template Hinge Dimensions: BHMA A156.7.

C. Quantity: Provide the following, unless otherwise indicated:
1. Three Hinges: For doors with heights 61 to 90 inches (1549 to 2286 mm).

D. Size: Provide the following, unless otherwise indicated, with hinge widths sized for door thickness and clearances required:

Maximum Door Size (inches)	Hinge Height (inches)	Metal Thickness (inches)	
		Standard Weight	Heavy Weight
32 by 84 by 1-3/8	3-1/2	0.123	-
36 by 84 by 1-3/8	4	0.130	-

E. Template Requirements: Except for hinges and pivots to be installed entirely (both leaves) into wood doors and frames, provide only template-produced units.

F. Hinge Applications: Unless otherwise indicated, provide the following:

1. Entrance Doors: Heavy-weight hinges.
2. Doors with Closers: Antifriction-bearing hinges.
3. Interior Doors: Standard-weight hinges.

G. Hinge Base Metal: Unless otherwise indicated, provide the following:

1. Exterior Hinges: Brass, with stainless-steel pin body and brass protruding heads.
2. Interior Hinges: Brass, with stainless-steel pin body and brass protruding heads.
3. Hinges for Fire-Rated Assemblies: Stainless steel, with stainless-steel pin.

H. Hinge Options: Comply with the following where indicated in the Door Hardware Schedule or on Drawings:
1. Nonremovable Pins: Provide set screw in hinge barrel that, when tightened into a groove in hinge pin, prevents removal of pin while door is closed; for the following applications:

a. Outswinging exterior doors.
2. Corners: Square 5/32-inch (4-mm) radius.

I. Fasteners: Comply with the following:

1. Machine Screws: For metal doors and frames. Install into drilled and tapped holes.
2. Wood Screws: For wood doors and frames.

3. Threaded-to-the-Head Wood Screws: For fire-rated wood doors.
4. Screws: Phillips flat-head screws; machine screws (drilled and tapped holes) for metal doors Finish screw heads to match surface of hinges.

2.2 HINGES

A. Antifriction-Bearing, Full-Mortise (Butt) Hinges: Heavy weight; BHMA Grade 1, with 4 ball bearings; button tips; nonrising removable pins; and base metal as follows:

1. Base Metal: Cast, forged, or extruded brass or bronze.

B. Plain-Bearing, Standard-Weight, Full-Mortise (Butt) Hinges: BHMA Grade 3, button tips, nonrising removable pins, and base metal as follows:

1. Base Metal: Cast, forged, or extruded brass or bronze.

2.3 LOCKS AND LATCHES, GENERAL

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. Mechanical Locks and Latches:
   a. Best Lock Corporation.
   b. Or approved equal.

B. Standards: Comply with the following:
1. Mortise Locks and Latches: ANSI/BHMA A156.13, Grade 1 Series 1000.
2. Cylindrical Locks: ANSI/BHMA A156.2, Grade 1 Series 4000.
3. Auxiliary Locks: BHMA A156.5, Grade 1
4. Exit Locks: BHMA A156.5.

C. Lock Trim: Comply with the following:

1. Lever: Wrought, forged, or cast.
2. Escutcheon (Rose): Wrought, forged, or cast.
3. Dummy Trim: Match lock trim and escutcheons.

D. Lock Functions: Function numbers or descriptions indicated in the Door Hardware Schedule comply with the following:
1. Mortise Locks: BHMA A156.13.
2. Cylindrical Locks: BHMA A156.2

E. Lock Throw: Comply with testing requirements for length of bolts to comply with labeled fire door requirements, and as follows:
1. Mortise Locks:
   a. 3/4-inch (19-mm) latchbolt throw.
   b. 1-inch (25-mm) deadbolt throw.
2. Cylindrical Locks: Provide deadlocking unless noted otherwise.
   a. 1/2-inch (13-mm) plain latchbolt throw.
   b. 1/2-inch (13-mm) deadlocking latchbolt throw.

F. Backset: 2-3/4 inches (70 mm), unless otherwise indicated.

2.4 DOOR BOLTS, GENERAL

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. Flush Bolts:

a. Adams Rite Manufacturing Co.
b. Glynn-Johnson; an Ingersoll-Rand Company.
c. Hager Companies.
d. Ives: H. B. Ives.

B. Standards: Comply with the following:
1. Manual Flush Bolts: BHMA A156.16.

2.5 EXIT DEVICES, GENERAL

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. Securitron Magnalock Corp.
2. Or approved equal

B. Standard: BHMA A156.3.

C. Certified Products: Provide exit devices listed in BHMA's "Directory of Certified Exit Devices."

D. Panic Exit Devices: Listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for panic protection, based on testing according to UL 305.

E. Fire Exit Devices: Complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire and panic protection, based on testing according to UL 305 and NFPA 252.

F. Outside Trim: Lever with cylinder; material and finish to match locksets, unless otherwise indicated.

1. Match design for locksets and latchsets, unless otherwise indicated.

2.6 EXIT DEVICES

A. Rim Exit Devices:

1. Securitron TSB

2.7 CYLINDERS AND KEYING

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Cylinders:
      a. Best Lock Corporation.
      b. Or approved equal.

B. Standards: Comply with the following:

   1. Cylinders: BHMA A156.5.

C. Cylinders: Manufacturer's standard tumbler type, constructed from brass or bronze, stainless steel, or nickel silver, and complying with the following:

   1. Number of Pins: Seven.
   2. Mortise Type: Threaded cylinders with rings and straight- or clover-type cam.
   3. Rim Type: Cylinders with back plate, flat-type vertical or horizontal tailpiece, and raised trim ring.

D. Permanent Cores: Manufacturer's standard; finish face to match lockset; complying with the following:
   1. Removable Cores: Core insert, removable by use of a special key, and for use with only the core manufacturer's cylinder and door hardware.

E. Construction Keying: Comply with the following:
   1. Construction Cores: Provide construction cores that are replaceable by permanent cores. Provide 10 construction master keys.
      a. Furnish permanent cores to Owner for installation.

F. Keying System: Unless otherwise indicated, provide a factory-registered keying system complying with the following requirements:
   1. Grand Master Key System: Cylinders are operated by a change key, a master key, and a grand master key.
   2. Existing System: Master key or grand master key locks to Owner's existing system.

      a. Cylinders shall be master keyed.

G. Keys: Provide nickel-silver keys complying with the following:

   1. Stamping: Permanently inscribe each key with a visual key control number and include the following notation:

      a. Notation: **"DO NOT DUPLICATE."**

      b. Quantity: In addition to one extra blank key for each lock, provide the following:

      c. Cylinder Change Keys: Three.
      d. Master Keys: Five.

H. Key Control System: BHMA Grade 1 system, including key-holding hooks, labels, two sets of key tags with self-locking key holders, key-gathering envelopes, and temporary and permanent markers. Contain system in metal cabinet with baked-enamel finish.
   1. Portable Cabinet: Tray for mounting in file cabinet, equipped with key-holding panels, envelopes, and cross-index system.

2. Capacity: Able to hold keys for 150 percent of the number of locks.

2.8 STRIKES

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:

B. Standards: Comply with the following:
1. Strikes for Mortise Locks and Latches: BHMA A156.13.
2. Strikes for Cylindrical Locks and Latches: ANSI Strikes 1-1/4 x 4-7/8.
3. Dustproof Strikes: BHMA A156.16.
4. Electric Strikes:

C. Strikes: Provide manufacturer's standard strike with strike box for each latch or lock bolt, with curved lip extended to protect frame, finished to match door hardware set, unless otherwise indicated, and as follows:

D. Dustproof Strikes: BHMA Grade 1, complying with the following:

1. Jamb Type: Polished wrought brass, with 3/4-inch- (19-mm-) diameter, spring-tension plunger.

2.9 ACCESSORIES FOR PAIRS OF DOORS, GENERAL

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. Astragals:

a. Hager Companies.
b. National Guard Products, Inc.
c. Pemko Manufacturing Co., Inc.
d. Reese Enterprises, Inc.
e. Ultra Industries; a Macklanburg-Duncan Company.
f. Zero International, Inc.

2.10 ACCESSORIES FOR PAIRS OF DOORS

A. Overlapping-with-Gasket Astragals: T-shaped metal, surface mounted on edge of door with screws; with integral gasket; and base metal as follows:

1. Base Metal: Primed steel.
2. Gasket Material: Polypropylene.

2.11 CLOSERS, GENERAL

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. Surface-Mounted Closers:

    a. Arrow Architectural Hardware; Div. of ESSEX Industries, Inc.
    b. LCN Closers; an Ingersoll-Rand Company.
    c. Norton Door Controls; Div. of Yale Security Inc.
    d. Rixson-Firemark, Inc.; Div. of Yale Security Inc.
    e. Sargent Manufacturing Company; Div. of ESSEX Industries, Inc.
    f. Yale Security Inc.; Div. of Williams Holdings.

B. Standards: Comply with the following:

1. Closers: BHMA A156.4.

C. Surface Closers: BHMA Grade 1.

2.12 CLOSERS

A. Modern-Type-with-Cover Surface Closers: Rack-and-pinion hydraulic type; with adjustable sweep and latch speeds controlled by key-operated valves; with forged-steel main arm; enclosed in cover indicated; complying with the following:

1. Mounting: Hinge side, top jamb.
2. Type: Regular arm.
3. Backcheck: Adjustable, effective between 60 and 85 degrees of door opening.
4. Cover Material: Aluminum.
5. Closing Power Adjustment: At least more than minimum tested value.

2.13 PROTECTIVE TRIM UNITS, GENERAL

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. Metal Protective Trim Units:
    a. Hiawatha, Inc.
    b. IPC Door and Wall Protection Systems, Inc.
    c. Ives: H. B. Ives.
    d. NT Quality Hardware; an Ingersoll-Rand Company.
    e. Pawling Corporation.
    f. Rockwood Manufacturing Company.

B. Standard: Comply with BHMA A156.6.

C. Materials: Fabricate protection plates from the following:
1. Bronze: 0.050 inch (1.3 mm) thick; beveled top and 2 sides.
    a. Color and Texture: As selected by Architect from manufacturer's full range.

D. Fasteners: Provide manufacturer's standard exposed fasteners for door trim units consisting of either machine or self-tapping screws.

E. Furnish protection plates sized 1-1/2 inches (38 mm) less than door width on push side and 1/2 inch (13 mm) less than door width on pull side, by height specified in schedule.

2.14 PROTECTIVE TRIM UNITS

A. Kick Plates: 12 inches (305 mm) high by door width unless noted otherwise, with allowance for frame stops.

B. Mop Plates: 6 inches (152 mm) high by 1 inch (25 mm) less than door width, unless noted othewise.

2.15 STOPS AND HOLDERS, GENERAL

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. Architectural Builders Hardware Mfg., Inc.
2. Glynn-Johnson; an Ingersoll-Rand Company.
3. Hager Companies.
4. Ives: H. B. Ives.
5. Yale Security Inc.; Div. of Williams Holdings.

B. Standards: Comply with the following:

1. Stops and Bumpers: BHMA A156.16.
2. Combination Overhead Holders and Stops: BHMA A156.8.
3. Door Silencers: BHMA A156.16.

C. Combination Overhead Stops and Holders: BHMA Grade 1, unless Grade 2 is indicated.

D. Silencers for Metal Door Frames: BHMA Grade 1; neoprene or rubber, minimum diameter 1/2 inch (13 mm); fabricated for drilled-in application to frame.

2.16 STOPS AND HOLDERS

A. Lever-Type Door Holders: Polished cast brass, bronze, or aluminum; consisting of 4-inch- (102-mm-) long arm that swings up and remains in vertical position; with replaceable rubber tip; surface-screw application.

2.17 OVERHEAD STOPS AND HOLDERS

A. Overhead Surface-Mounted, Jointed-Arm Stops: Release by push and pull of door; control capable of being set in inactive position; with stop and shock absorber; for single-acting doors opening 110 degrees.

2.18 WALL BUMPERS

A. Wrought, finish to match lock trim.

B. Rubber

C. Concealed mounting.

2.19 DOOR GASKETING, GENERAL

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. Door Gasketing:
   a. National Guard Products, Inc.
   b. Pemko Manufacturing Co., Inc.
   c. Reese Enterprises, Inc.
   d. Sealeze Corporation.
   e. Zero International, Inc.

2. Door Bottoms:

   a. Hager Companies.
   b. National Guard Products, Inc.
   c. Pemko Manufacturing Co., Inc.
   d. Reese Enterprises, Inc.
   e. Zero International, Inc.

B. Standard: Comply with BHMA A156.22.

C. General: Provide continuous weather-strip gasketing on exterior doors and provide smoke, light, or sound gasketing on interior doors where indicated or scheduled. Provide noncorrosive fasteners for exterior applications and elsewhere as indicated.

1. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.
2. Door Bottoms: Apply to bottom of door, forming seal with threshold when door is closed.

D. Air Leakage: Not to exceed 0.50 cfm per foot (0.000774 cu. m/s per m) of crack length for gasketing other than for smoke control, as tested according to ASTM E 283.

E. Fire-Labeled Gasketing: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to UL 10B or NFPA 252.

F. 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.

G. Replaceable Seal Strips: Provide only those units where resilient or flexible seal strips are easily replaceable and readily available from stocks maintained by manufacturer.

H. Gasketing Materials: Comply with ASTM D 2000 and AAMA 701/702.

2.20 DOOR GASKETING

A. Rigid, Housed Perimeter Gasketing: Gasket material held in place by metal housing; fastened to frame stop with screws.

1. Gasket Material: Polyurethane bulb.
2. Housing Material: Stainless steel.

B. Door Sweeps: Gasket material held in place by flat metal housing or flange; surface mounted to face of door with screws.

1. Gasket Material: Polyurethane.
2. Housing Material: Bronze.

C. Automatic Door Bottoms: Gasket material held in place by metal housing that automatically drops to form seal when door is closed; mounted to bottom edge of door with screws.

1. Gasket Material: Sponge neoprene Nylon brush.
2. Housing Material: Aluminum with 0.047-inch (1.2-mm) lead lining.
3. Mounting: Surface mounted on face of door.
4. Type: Low-closing-force type for doors required to meet accessibility requirements.

2.21 THRESHOLDS, GENERAL

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. National Guard Products, Inc.
2. NT Dor-O-Matic Hardware Div.; an Ingersoll-Rand Company.
3. Pemko Manufacturing Co., Inc.
4. Reese Enterprises, Inc.
5. Zero International, Inc.

B. Standard: Comply with BHMA A156.21.

2.22 THRESHOLDS

A. Ramped Thresholds: Modular, interlocking, sloped, fluted-top metal assemblies with closed return ends; 1:12 slope; and Aluminum base metal.:

2.23 CARD READERS

Not used.

2.24 FABRICATION

A. Base Metals: Produce door hardware units of base metal, fabricated by forming method indicated, using manufacturer's standard metal alloy, composition, temper, and hardness. Furnish metals of a quality equal to or greater than that of specified door hardware units and BHMA A156.18 for finishes. Do not furnish manufacturer's standard materials or forming methods if different from specified standard.

B. Fasteners: Provide door hardware manufactured to comply with published templates generally prepared for machine, wood, and sheet metal screws. Provide screws according to commer-

cially recognized industry standards for application intended. Provide Phillips flat-head screws with finished heads to match surface of door hardware, unless otherwise indicated.

1. Concealed Fasteners: For door hardware units that are exposed when door is closed, except for units already specified with concealed fasteners. Do not use through bolts for installation where bolt head or nut on opposite face is exposed unless it is the only means of securely attaching the door hardware. Where through bolts are used on hollow door and frame construction, provide sleeves for each through bolt.

2. Steel Machine or Wood Screws: For the following fire-rated applications:

   a. Mortise hinges to doors.
   b. Strike plates to frames.
   c. Closers to doors and frames.

3. Steel Through Bolts: For the following fire-rated applications, unless door blocking is provided:
   a. Closers to doors and frames.
   b. Surface-mounted exit devices.

4. Spacers or Sex Bolts: For through bolting of hollow metal doors.
5. Fasteners for Wood Doors: Comply with requirements of DHI WDHS.2, "Recommended Fasteners for Wood Doors."

2.25 FINISHES

A. Standard: Comply with BHMA A156.18.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
   1. Provide Architect with samples of Finishes for selection from standard .BHMA Designations.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine doors and frames, with Installer present, for compliance with requirements for installation tolerances, labeled fire door assembly construction, wall and floor construction, and other conditions affecting performance of door hardware.

B. Examine roughing-in for electrical power systems to verify actual locations of wiring connections before electrified door hardware installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Steel Doors and Frames: Comply with DHI A115 series, or ANSI/BHMA A156.115.

B. Wood Doors: Comply with DHI A115-W series, or ANSI/BHMA A156.115-W.

3.3 INSTALLATION

A. 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:
   a. DHI's "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."
   b. ANSI “Hardware Preparation in Steel Doors and Steel Frames.”
2. Custom Steel Doors and Frames: DHI's "Recommended Locations for Builders' Hardware for Custom Steel Doors and Frames."
3. Wood Doors:
   a. DHI WDHS.3, "Recommended Locations for Architectural Hardware for Wood Flush Doors."
   b. ANSI “Hardware Preparation in Wood Doors with Wood or Steel Frames.”

B. Install each door hardware item to comply with manufacturer's written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work specified in Division 9 Sections. Do not install surface-mounted items until finishes have been completed on substrates involved.

1. Set units level, plumb, and true to line and location. Adjust and reinforce attachment substrates as necessary for proper installation and operation.
2. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.

C. Key Control System: Place keys on markers and hooks in key control system cabinet, as determined by final keying schedule.

D. Thresholds: Set thresholds for exterior and acoustical doors in full bed of sealant complying with requirements specified in Division 7 Section "Joint Sealants."

3.4 FIELD QUALITY CONTROL

1. Independent Architectural Hardware Consultant will inspect door hardware and state in each report whether installed work complies with or deviates from requirements, including whether door hardware is properly installed and adjusted.

3.5 ADJUSTING

A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.
   1. Door Closers: Adjust sweep period so that, from an open position of 70 degrees, the door will take at least 3 seconds to move to a point 3 inches (75 mm) from the latch, measured to the leading edge of the door.

B. Six-Month Adjustment: Approximately six months after date of Substantial Completion, Installer shall perform the following:

   1. Examine and readjust each item of door hardware as necessary to ensure function of doors, door hardware, and electrified door hardware.
   2. Consult with and instruct Owner's personnel on recommended maintenance procedures.
   3. Replace door hardware items that have deteriorated or failed due to faulty design, materials, or installation of door hardware units.

3.6 CLEANING AND PROTECTION

A. Clean adjacent surfaces soiled by door hardware installation.

B. Clean operating items as necessary to restore proper function and finish.

C. Provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of Substantial Completion.

3.7 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain door hardware and door hardware finishes.

3.8 DOOR HARDWARE SCHEDULE

A. Exposed finishes selected by Architect.

HW – 1A
Door #'s: 10 Lobby (Aluminum /Glass, Swing Door)

2	Exit Device (concealed vertical rod)	Rim, Lever trim
2	Closure	
1	Lockset (Storeroom Lock w/Dead bolt)	Mortise lock, Lock Trim
2	Pull w/ Thumb Latch	
1	Threshold	Ramped type, fluted
1	Weather stripping pack	
2	Pull	

HW – 1B
Door #'s: 102 Multi-Purpose Room (Aluminum /Glass, Swing Door), 111A Fitness Room (Aluminum /Glass, Swing Door)

3	Hinges (1 ½ pair)	Plain bearing, full mortise, standard weight
1	Lockset (Passage w/ Dead bolt)	
1	Closure	
1	Silencer pack	

HW – 2
Door #'s: 201A, 201E, & 201 F Locker Room- Men (WD, Single)

3	Hinges (1 ½ pair)	Antifriction bearing, full mortise, non-rising pin, heavy weight
1	Closure	
1	Silencer pack	
1	Kick Plate	12" Bronze
1	Mop Plate	6" Bronze
1	Push	
1	Pull	

HW – 3A
Door #'s: 101 Restroom (WD, Single), 104 Restroom (WD, Single), 212 Locker Room - Women (WD, Single), 214 Unisex (WD, Single)

3	Hinges (1 ½ pair)	Antifriction bearing, full mortise, non-rising pin, heavy weight
1	Lockset (Privacy Lock)	Cylindrical lock, Lock trim
1	Closure	
1	Silencer pack	

HW – 3B

Door #'s: 112C Shower (WD, Single), 112D Shower (WD, Single), 112E Shower (WD, Single), 200C Restroom (WD, Single), 201B Shower (WD, Single), 201C Shower (WD, Single), 201D Shower (WD, Single), 202C Restroom (WD, Single), 203C Restroom (WD, Single)

3	Hinges (1 ½ pair)	Antifriction bearing, full mortise, non-rising pin, heavy weight
1	Lockset (Privacy Lock)	Cylindrical lock, Lock trim
1	Silencer pack	

HW – 4
Door #'s: 100 Watch Office (WD, Single), 103A Triage (WD, Single),103C Triage (WD, Single), 107A Office (WD, Single), 200 Office (WD, Single), 202 Office (WD, Single), 203 Office (WD, Single),

3	Hinges (1 ½ pair)	Plain bearing, full mortise, standard weight
1	Lockset (Office Lock)	Cylindrical lock, Lock trim
1	Closure w/hold open	
1	Silencer pack	

HW – 5
Door #'s: 103B Storage (WD, Single), 107B Storage (WD, Single)

3	Hinges (1 ½ pair)	Plain bearing, full mortise, standard weight
1	Lockset (Storeroom Lock)	Cylindrical lock, Lock trim
1	Silencer pack	

HW – 6A
Door #'s: A1A Stairwell (HM, Single UL Listed), B1A Stairwell (HM, Single UL Listed),

3	Hinges (1 ½ pair)	Antifriction bearing, full mortise, non-rising pin, heavy weight
1	Exit Device	Rim, Level Trim
1	Lockset (Passage)	
1	Pull w/ Thumb Latch	
1	Kick Plate	12" Bronze

HW – 6B
Door #'s: A1B Stairwell (HM, Single UL Listed), B1B Stairwell (HM, Single UL Listed), 22A Pole A (HM, Single UL Listed), 22B Pole B (HM, Single UL Listed)

3	Hinges (1 ½ pair)	Antifriction bearing, full mortise, non-rising pin, heavy weight
1	Exit Device	Rim, Level Trim
1	Kick Plate	12" Bronze
1	Door Gasketing	Rigid Head and Jamb
1	Door Gasketing	Door Bottom

HW – 6C
Door #'s: A1C Stairwell (HM, Single UL Listed), B1C Stairwell (HM, Single UL Listed), A3 Stairwell (HM, Single UL Listed), 12 Corridor (HM, Single), 115E Engine Bay (HM, Single), 115J Engine Bay (HM, Single UL),

3	Hinges (1 ½ pair)	Antifriction bearing, full mortise, non-rising pin, heavy weight
1	Exit Device	Rim, Level Trim
1	Lockset (Entry)	
1	Closure	
1	Kick Plate	12" Bronze
1	Door Gasketing	Rigid Head and Jamb
1	Door Gasketing	Door Bottom
1	Threshold	Ramped type, fluted
1	Metal Drip	

HW – 7A
Door #'s: 112B Laundry / Decon (HM, Single UL Listed), 113A Turnout Gear (HM, Single UL Listed)

3	Hinges (1 ½ pair)	Antifriction bearing, full mortise, non-rising pin, heavy weight
1	Exit Device	Rim, Level Trim
1	Lockset (passage)	
1	Closure w/ hold open	

1	Kick Plate	12” Bronze
1	Door Gasketing	Rigid Head and Jamb
1	Door Gasketing	Door Sweep

HW – 7B
Door #’s: 112A Laundry / Decon. (WD, Single), 113B Turnout Gear (WD, Single), 113C Turnout Gear (WD, Single)

3	Hinges (1 ½ pair)	Antifriction bearing, full mortise, non-rising pin, heavy weight
1	Push Plate	
1	Pull	
1	Closure	
1	Kick Plate	12” Bronze

HW – 8A
Door #’s: 15 Mechanical (HM, Pair, UL Listed),

6	Hinges (1 ½ pair)	Antifriction bearing, full mortise, non-rising pin, heavy weight
1	Lockset (Storeroom Lock w/Dead bolt)	Mortise lock, Lock Trim
1	Closure w/ hold open	
2	Flush Bolts	
1	Astragal	
1	Door Gasketing	Rigid Head and Jamb
1	Door Gasketing	Door Sweep
1	Threshold	Ramped type, fluted
1	Metal Drip	

HW – 8B
Door #’s: 114 Shop (HM, Pair, UL Listed),

6	Hinges (1 ½ pair)	Antifriction bearing, full mortise, non-rising pin, heavy weight
1	Lockset (Storeroom Lock w/Dead bolt)	Mortise lock, Lock Trim
2	Flush Bolts	
1	Astragal	
1	Closure w/ hold open	
1	Kick Plate	12” Bronze
1	Door Gasketing	Rigid Head and Jamb
1	Door Gasketing	Door Sweep

HW – 9A
Door #’s: 14 Riser Room (WD, Single), 106 IT Room (WD Single), 214 Mech (HM, Single, UL Listed)

3	Hinges (1 ½ pair)	Antifriction bearing, full mortise, non-rising pin, heavy weight
1	Lockset (Storeroom)	Cylindrical lock, Lock trim
1	Closure	

HW – 9B
Door #: 105 Janitor Closet (WD, Single), 217 Janitors Closet (WD, Single), 132 Supply (WD, Single), 135 Laundry (WD, Single)

3	Hinges (1 ½ pair)	Plain bearing, full mortise, standard weight
1	Lockset (Storeroom)	Cylindrical lock, Lock trim
1	Closure w/hold open	
1	Silencer pack	
1	Kick Plate	12” Bronze
1	Mop Plate	6” Bronze

HW – 10A
Door #’s: 115B Engine Bay (Four Fold), 115C Engine Bay (Four Fold), 115D Engine Bay (Four Fold), 115G Engine Bay (Four Fold), 115H Engine Bay (Four Fold), 115I Engine Bay (Four Fold),

Hardware by door manufacturer per Section 08365.

HW – 10B
Door #’s: 13 Storage Room (Overhead), 111B Fitness Room (Overhead),

Hardware by door manufacturer per Section 08365.

HW – 11
Door #: 21A Corridor (WD, Single), 21B Corridor (WD, Single), 200B Bunk (WD, Single), 202B Bunk (WD, Single), 203B Bunk (WD, Single), 218 Laundry (WD, Single), 22C Pole A (HM, Single), 22D Pole B (HM, Single)

3	Hinges (1 ½ pair)	Antifriction bearing, full mortise, non-rising pin, heavy weight
1	Lockset (passage)	Cylindrical, Lock Trim
1	Silencer pack	
1	Closure	

END OF SECTION

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 glazing for the following products, including those specified in other Sections where glazing requirements are specified by reference to this Section:
   1. Window units.
   2. Vision lites.
   3. Entrances and other doors.

B. Related Sections: The following sections contain requirements that relate to this Section.

1.3 DEFINITIONS

A. Manufacturer is used in this Section to refer to a firm that produces primary glass or fabricated glass as defined in the referenced glazing standard.

B. Deterioration of Insulating Glass: Failure of the hermetic seal under normal use due to causes other than glass breakage and improper practices for maintaining, and cleaning insulating glass. Evidence of failure is the obstruction of vision by dust, moisture, or film on the interior surfaces of glass. Improper practices for maintaining and cleaning glass do not comply with the manufacturer's directions.

1.4 SYSTEM PERFORMANCE REQUIREMENTS

A. General: Provide glazing systems that are produced, fabricated, and installed to withstand normal thermal movement, wind loading, and impact loading (where applicable), without failure including loss or glass breakage attributable to the following: defective manufacture, fabrication, and installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; and other defects in construction.

B. Glass Design: Glass thicknesses indicated on Drawings are for detailing only. Confirm glass thicknesses by analyzing Project loads and in-service conditions. Provide glass lites for the various size openings in the thicknesses and strengths (annealed or heat-treated) to meet or exceed the following criteria:
   1. Minimum glass thickness, nominally, of lites in exterior walls is 6 mm.
   2. Tinted and heat-absorbing glass thicknesses for each tint indicated are the same throughout Project.
   3. Minimum glass thicknesses of lites, whether composed of annealed or heat-treated glass, are selected so the worst-case probability of failure does not exceed the following:
      a. 8 lites per 1000 for lites set vertically or not over 15 degrees off vertical and under wind action. Determine minimum thickness of monolithic annealed glass according to ASTM E 1300. For other than monolithic annealed glass, determine thickness per glass manufacturer's standard method of analysis including applying adjustment factors to ASTM E 1300 based on type of glass.
      b. 1 lite per 1000 for lites set over 15 degrees off vertical and under action of wind or snow.

C. Normal thermal movement results from the following maximum change (range) in ambient and surface temperatures acting on glass-framing members and glazing components. Base engineering calculation on materials' actual surface temperatures due to both solar heat gain and nighttime sky heat loss.

1. Temperature Change (Range): 120 F deg (67 C deg), ambient; 180 F deg (100 C deg), material surfaces.

D. Fire Rated Glass Units
1. Fire-rated clear and wireless glazing material for use in impact safety-rated locations such as doors, sidelites, transoms, borrowed lites and wall applications with fire rating requirements of 45 minutes to one hour; for use in interior or exterior applications. Consult manufacturer for exterior applications
2. Passes positive pressure test standards UL 10C, UBC 7-2, UBC 7-4.
3. Provides protection from radiant and conductive heat transfer.

1.5 SUBMITTALS

A. General: Submit the following according to Conditions of Contract and Division 1 Specification Sections.

B. Product data for each glass product and glazing material indicated.

C. Product certificates signed by glazing materials manufacturers certifying that their products comply with specified requirements.
1. Separate certifications are not required for glazing materials bearing manufacturer's permanent labels designating type and thickness of glass, provided labels represent a quality control program of a recognized certification agency or independent testing agency acceptable to authorities having jurisdiction.

D. Compatibility and adhesion test reports from sealant manufacturer indicating that glazing materials were tested for compatibility and adhesion with glazing sealants. Include sealant manufacturer's interpretation of test results relative to sealant performance and recommendations for primers and substrate preparation needed for adhesion.

E. Compatibility test report from manufacturer of insulating glass edge sealant indicating that glass edge sealants were tested for compatibility with other glazing materials including sealants, glazing tape, gaskets, setting blocks, and edge blocks.

1.6 QUALITY ASSURANCE

A. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below, except where more stringent requirements are indicated. Refer to these publications for glazing terms not otherwise defined in this Section or in referenced standards.
1. FGMA Publications: "FGMA Glazing Manual."
2. AAMA Publications: AAMA TIR-A7 "Sloped Glazing Guidelines" and "Glass Design for Sloped Glazing."
3. LSGA Publications: "LSGA Design Guide."
4. SIGMA Publications: TM-3000 "Vertical Glazing Guidelines" and TB-3001 "Sloped Glazing Guidelines."

B. Safety Glass: Products complying with ANSI Z97.1 and testing requirements of 16 CFR Part 1201 for Category II materials.
   1. Subject to compliance with requirements, provide safety glass permanently marked with certification label of Safety Glazing Certification Council (SGCC) or other certification agency acceptable to authorities having jurisdiction.

C. Insulating Glass Certification Program: Provide insulating glass units permanently marked either on spacers or at least one component lite of units with appropriate certification label of inspecting and testing agency indicated below:
   1. Insulating Glass Certification Council (IGCC).
   2. Associated Laboratories, Inc. (ALI).
   3. National Certified Testing Laboratories (NCTL).

D. Glazier Qualifications: Engage an experienced glazier who has completed glazing similar in material, design, and extent to that indicated for Project with a record of successful in-service performance.

E. Single-Source Responsibility for Glass: Obtain glass from one source for each product indicated below:
   1. Primary glass of each (ASTM C 1036) type and class indicated.
   2. Heat-treated glass of each (ASTM C 1048) condition indicated.
   3. Laminated glass of each (ASTM C 1172) kind indicated.
   4. Insulating glass of each construction indicated.

F. Single-Source Responsibility for Glazing Accessories: Obtain glazing accessories from one source for each product and installation method indicated.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Protect glazing materials to comply with manufacturer's directions and as needed to prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.
   1. Where insulating glass units will be exposed to substantial altitude changes, comply with insulating glass fabricator's recommendations for venting and sealing to avoid hermetic seal ruptures.

1.8 PROJECT CONDITIONS

A. Environmental Conditions: Do not proceed with glazing when ambient and substrate temperature conditions are outside the limits permitted by glazing materials manufacturer or when glazing channel substrates are wet from rain, frost, condensation, or other causes.
   1. Install liquid sealants at ambient and substrate temperatures above 40 deg F (4 deg C).

1.9 WARRANTY

A. General: Warranties specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and will be in addition to and run concurrent with other warranties made by the Contractor under requirements of the Contract Documents.

B. Manufacturer's Warranty on Insulating Glass: Submit written warranty signed by manufacturer of

insulating glass agreeing to furnish replacements for insulating glass units that deteriorate as defined in "Definitions" article, f.o.b. point of manufacture, freight allowed Project site, within specified warranty period indicated below. Warranty covers only deterioration due to normal conditions of use and not to handling, installing, protecting, and maintaining practices contrary to glass manufacturer's published instructions.

1. Warranty Period: Manufacturer's standard but not less than 10 years after date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PRIMARY FLOAT GLASS PRODUCTS

A. Float Glass: ASTM C 1036, Type I (transparent glass, flat), Class as indicated below, and Quality q3 (glazing select).
   1. Class 1 (clear) unless otherwise indicated.

B. Refer to requirements for sealed insulating glass units for performance characteristics of assembled units composed of tinted glass, coated or uncoated, relative to visible light transmittance, U-values, shading coefficient, and visible reflectance.

2.2 HEAT-TREATED FLOAT GLASS PRODUCTS, GENERAL

A. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed, unless otherwise indicated.

2.3 HEAT-TREATED FLOAT GLASS

A. Uncoated, Clear, Heat-Treated Float Glass: ASTM C 1048, Condition A (uncoated surfaces), Type I (transparent glass, flat), Class 1 (clear), Quality q3 (glazing select), kind as indicated below.
   2. Kind FT (fully tempered) where indicated.

B. Available Manufacturers: Subject to compliance with requirements, manufacturers offering heat-treated glass products that may be incorporated in the Work include, but are not limited to, the following companies.

C. Manufacturers: Subject to compliance with requirements, provide heat-treated glass by one of the following companies.
   1. AFG Industries, Inc.
   2. Cardinal IG.
   3. Guardian Industries Corp.
   4. PPG Industries, Inc.
   5. Spectrum Glass Products, Inc.
   6. GE

2.4 WIRED GLASS

A. Wired Glass: ASTM C 1036, Type II (patterned and wired glass, flat), Class 1 (clear), Quality q8 (glazing); 6.4 mm thick; of form and mesh pattern indicated below:
   1. Polished Wired Glass: Form 1 (wired, polished both sides), and as follows:
      a. Mesh m1 (diamond).
      b. Mesh m2 (square).

2. Patterned Wired Glass: Form 2 (patterned and wired), Mesh m1 (diamond).

B. Available Manufacturers: Subject to compliance with requirements, manufacturers offering wired glass products that may be incorporated in the Work include, but are not limited to, the following companies.

C. Manufacturers: Subject to compliance with requirements, provide wired glass by one of the following companies.
1. Polished Wired Glass:
   a. Ashai Glass Co.
   b. Central Glass Co., Ltd.
   c. Nippon Sheet Glass Ltd.
   d. Pilkington Sales (North America) Ltd.
2. Patterned Wired Glass:
   a. AFG Industries, Inc.

2.5 FIRE RATED GLASS PRODUCTS

A. Manufacturers: Subject to compliance with requirements manufacturers offering fire rated glass products that may be incorporated in the Work include, but are not limited to, the following companies.
1. AGC InterEdge Technologies: Pyrobol series
2. Pilkington: Pyrostop series
3. Safti First: SuperIIte series
4. Schott North America: Pyran series
5. Technical Glass Products (TGP): Firelite series
6. Vetrotech Saint-Gobain North America: Keralite series

B. Properties
1. Thickness: Varies with rating and application (range from 5/8” to 2-1/8”)
2. Weight: Varies with thickness (approximate range 8 to 25 lbs./sq. ft.).
3. Approximate Visible transmission: Varies with thickness. (Approximate range 85 to 71 percent).
4. Fire Rating: 45 to 60 minutes
5. Impact Safety Performance: ANSI Z97.1 (Cat. I and II).
6. Hose Steam tested
7. Heat Resistant

C. Fire Rating: Fire Rating listed and labeled by UL for fire rating scheduled at opening locations in drawings, when tested in accordance with ASTM-E152 and ASTM E119

2.6 INSULATING GLASS PRODUCTS

A. Sealed Insulating Glass Units: Preassembled units consisting of organically sealed lites of glass separated by dehydrated air spaces complying with ASTM E 774 and with other requirements indicated.
1. For properties of individual glass lites making up units, refer to requirements specified elsewhere in this Section applicable to types, classes, kinds, and conditions of glass products comprising lites of insulating glass units.
2. Provide heat-treated, coated float glass of kind indicated or, if not otherwise indicated, Kind HS (heat strengthened) where recommended by manufacturer to comply with system performance requirements specified and Kind FT (fully tempered) where safety glass is designated or required.

3. Performance characteristics designated for coated insulating glass are nominal values based on manufacturer's published test data for units with lites 6 mm thick and nominal 1/2-inch (13 mm) dehydrated space between lites, unless otherwise indicated.
4. U-values are expressed as Btu/hr x sq. ft. x deg F (W/sq. m x K).
5. Color: Provide samples for selection from a full range of manufacturers colors.
    a. Tinted units, unless noted otherwise.

2.7 HIGH REFLECTIVE COATED GLASS (ONE-WAY VISION GLASS)

A. Reflective Coated Glass units:
1. Performance characteristics as follows:
    a. Glass Thickness: 1/4” / 6mm
    b. Glass Substrate: Grey
    c. Visible Transmittance: 11%
    d. Visible Reflectance Coated Side: 68%
    e. Visible Reflectance Glass Side: 16%
2. Locations: Storefront Entrance Doors. Other locations indicated on drawings.

B. Available Manufacturers: Subject to compliance with requirements, manufacturers offering reflective coated glass products that may be incorporated in the Work include, but are not limited to, the following companies.

C. Manufacturers: Subject to compliance with requirements, provide reflective coated glass by one of the following companies.

1. Ashai Glass Co.
2. Central Glass Co., Ltd.
3. Nippon Sheet Glass Ltd.

2.8 ELASTOMERIC GLAZING SEALANTS

D. General: Provide products of type indicated, complying with the following requirements:
1. Compatibility: Select glazing sealants and tapes of proven compatibility with other materials they will contact, including glass products, seals of insulating glass units, and glazing channel substrates, under conditions of installation and service, as demonstrated by testing and field experience.
2. Suitability: Comply with sealant and glass manufacturer's recommendations for selecting glazing sealants and tapes that are suitable for applications indicated and conditions existing at time of installation.
3. Colors: Provide color of exposed joint sealants to comply with the following:
    a. Provide selections made by Architect from manufacturer's full range of standard colors for products of type indicated.

E. Elastomeric Glazing Sealant Standard: Provide manufacturer's standard chemically curing, elastomeric sealants of base polymer indicated that comply with ASTM C 920 requirements.
1. Additional Movement Capability: Where additional movement capability is specified, provide products, when tested for adhesion and cohesion under maximum cyclic movement per ASTM C19, with the capability to withstand the specified percentage change in the joint width existing at time of installation and remain in compliance with other requirements of ASTM C920 for uses indicated.

F. Glazing Sealant for Fire-Resistant Glazing Products: Identical to product used in test assembly to

obtain fire-resistive rating.

2.9 GLAZING GASKETS

A. Lock-Strip Gaskets: Neoprene extrusions in size and shape indicated, fabricated into frames with molded corner units and zipper lock strips, complying with ASTM C542, black.

B. Dense Compression Gaskets: Molded or extruded gaskets of material indicated below, complying with standards referenced with name of elastomer indicated below, and of profile and hardness required to maintain watertight seal:
1. Neoprene, ASTM C 864.
2. EPDM, ASTM C 864.
3. Silicone, ASTM C 1115.
4. Thermoplastic polyolefin rubber, ASTM C 1115.

C. Soft Compression Gaskets: Extruded or molded closed-cell, integral-skinned gaskets of material indicated below, complying with ASTM C 509, Type II, black, and of profile and hardness required to maintain watertight seal:
1. Neoprene.
2. EPDM.
3. Silicone.
4. Thermoplastic polyolefin rubber.

D. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the work include, but are not limited to, the following companies.

E. Manufacturers: Subject to compliance with requirements, provide products by one of the following companies.
1. Lock-Strip Gaskets:
   a. Stanlock Div., Griffith Rubber Mills.
2. Preformed Gaskets:
   a. Advanced Elastomer Systems, L.P.
   b. Schnee-Morehead, Inc.
   c. Tremco, Inc.

2.10 MISCELLANEOUS GLAZING MATERIALS

A. General: Provide products of material, size, and shape complying with referenced glazing standard, requirements of manufacturers of glass and other glazing materials involved for glazing application indicated, and with a proven record of compatibility with surfaces contacted in installation.

B. Cleaners, Primers and Sealers: Type recommended by sealant or gasket manufacturer.

C. Setting Blocks: Elastomeric material with a Shore A durometer hardness of 85 plus or minus 5.

D. Spacers: Elastomeric blocks or continuous extrusions with a Shore A durometer hardness required by glass manufacturer to maintain glass lites in place for installation indicated.

E. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side-walking).

F. Plastic Foam Joint Fillers: Preformed, compressible, resilient, nonstaining, nonextruding, nonoutgassing, strips of closed-cell plastic foam of density, size, and shape to control sealant depth and otherwise contribute to produce optimum sealant performance.

G. Perimeter Insulation for Fire-Resistive Glazing: Identical to product used in test assembly to obtain fire-resistive rating.

2.11 FABRICATION OF GLASS AND OTHER GLAZING PRODUCTS

A. Fabricate glass and other glazing products in sizes required to glaze openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with recommendations of product manufacturer and referenced glazing standard as required to comply with system performance requirements.

B. Clean cut or flat grind vertical edges of butt-glazed monolithic lites in a manner that produces square edges with slight kerfs at junctions with indoor and outdoor faces.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine glass framing, with glazier present, for compliance with the following:
1. Manufacturing and installation tolerances, including those for size, squareness, offsets at corners.
2. Presence and functioning of weep system.
3. Minimum required face or edge clearances.
4. Effective sealing between joints of glass-framing members.

B. Do not proceed with glazing until unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings that are not firmly bonded to substrates.

3.3 GLAZING, GENERAL

A. Comply with combined recommendations of manufacturers of glass, sealants, gaskets, and other glazing materials, except where more stringent requirements are indicated, including those in referenced glazing publications.

B. Glazing channel dimensions as indicated on Drawings provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances. Adjust as required by Project conditions during installation.

C. Protect glass from edge damage during handling and installation as follows:
1. Use a rolling block in rotating glass units to prevent damage to glass corners. Do not impact glass with metal framing. Use suction cups to shift glass units within openings; do not raise or drift glass with a pry bar. Rotate glass lites with flares or bevels on bottom horizontal edges so edges are located at top of opening, unless otherwise indicated by

manufacturer's label.

2. Remove damaged glass from Project site and legally dispose of off site. Damaged glass is glass with edge damage or other imperfections that, when installed, weaken glass and impair performance and appearance.

D. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction sealant-substrate testing.

E. Install elastomeric setting blocks in sill rabbets, sized and located to comply with referenced glazing standard, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.

F. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.

G. Provide spacers for glass sizes larger than 50 united inches (1250 mm) (length plus height) as follows:

1. Locate spacers inside, outside, and directly opposite each other. Install correct size and spacing to preserve required face clearances, except where gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and comply with system performance requirements.
2. Provide 1/8-inch (3 mm) minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.

H. Provide edge blocking to comply with requirements of referenced glazing publications, unless otherwise required by glass manufacturer.

I. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.

J. Where wedge-shaped gaskets are driven into one side of channel to pressurize sealant or gasket on opposite side, provide adequate anchorage so gasket cannot walk out when installation is subjected to movement.

K. Square cut wedge-shaped gaskets at corners and install gaskets in manner recommended by gasket manufacturer to prevent corners from pulling away; seal corner joints and butt joints with sealant recommended by gasket manufacturer.

3.4 GASKET GLAZING (DRY)

A. Fabricate compression gaskets in lengths recommended by gasket manufacturer to fit openings exactly, with stretch allowance during installation.

B. Secure compression gaskets in place with joints located at corners to compress gaskets producing a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.

C. Install gaskets so they protrude past face of glazing stops.

3.5 SEALANT GLAZING (WET)

A. Install continuous spacers between glass lites and glazing stops to maintain glass face clearances and to prevent sealant from extruding into glass channel weep systems until sealants cure.

Secure spacers in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.

B. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.

C. Tool exposed surfaces of sealants to provide a substantial wash away from glass. Install pressurized gaskets to protrude slightly out of channel to eliminate dirt and moisture pockets.

3.6 LOCK-STRIP GASKET GLAZING

A. Comply with ASTM C 716 and gasket manufacturer's printed recommendations. Provide supplementary wet seal and weep system unless otherwise indicated.

3.7 PROTECTION AND CLEANING

A. Protect exterior glass from breakage immediately after installation by attaching crossed streamers to framing held away from glass. Do not apply markers to glass surface. Remove nonpermanent labels, and clean surfaces.

B. Protect glass from contact with contaminating substances resulting from construction operations including weld splatter. If, despite such protection, contaminating substances do come into contact with glass, remove them immediately as recommended by glass manufacturer.

C. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for build-up of dirt, scum, alkali deposits, or stains, and remove as recommended by glass manufacturer.

D. Remove and replace glass that is broken, chipped, cracked, abraded, or damaged in any way, including natural causes, accidents and vandalism, during construction period.

E. Wash glass on both faces in each area of Project not more than 4 days prior to date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended by glass manufacturer.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Interior non load-bearing steel stud partition framing 20 gage and lighter (designed for 5 pounds per square foot uniform load perpendicular to partition).
2. Gypsum board.
3. Gypsum sheathing.

B. Related Sections:
1. Section 05400 - Cold Formed Metal Framing: Load-bearing steel stud exterior and interior wall framing 20 gage and heavier and ceiling joists. Cold formed deep leg track for interior nonload-bearing steel stud partitions. Metal stud header wall framing and bracing supported from roof structure.
2. Section 06100 - Rough Carpentry: Wood furring strips, plywood, blocking, and fasteners attached to partition framing.
3. Section 07840 - Firestopping: Installation of firestopping at penetrations of fire-rated partitions.
4. Section 09900 - Painting: Paint finish applied to gypsum board.

1.2 REFERENCES

A. The publications listed below form a part of this specification to the extent referenced. Publications are referenced within the text by the basic designation only.

B. ASTM International (ASTM):
1. ASTM A 653 - Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
2. ASTM C475 - Joint Compound and Joint Tape for Finishing Gypsum Board.
3. ASTM C 557 - Adhesives for Fastening Gypsum Wallboard to Wood Framing.
4. ASTM C 645 - Nonstructural Steel Framing Members.
5. ASTM C 754 - Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products.
6. ASTM C 840 - Application And Finishing Of Gypsum Board.
7. ASTM C 954 - Steel Drill Screws for the Application of Gypsum Board or Metal Plaster Bases to Steel Studs From 0.033 inches to 0.112 inches in Thickness.
8. ASTM C 1002 - Steel Self-Piercing Tapping Screws For The Application Of Gypsum Panel Products Or Metal Plaster Bases To Wood Studs Or Steel Studs.
9. ASTM C 1177 - Glass Mat Gypsum Substrate for Use as Sheathing.
10. ASTM C 1178 - Coated Glass Mat Water-Resistant Gypsum Backing Panel.
11. ASTM C 1288 - Discrete Non-Asbestos Fiber-Cement Interior Substrate Sheets.
12. ASTM C 1396 - Gypsum Board.
13. ASTM D 3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber.
14. ASTM D 3274 - Standard Test Method for Evaluating Degree of Surface Disfigurement of Paint Films by Microbial (Fungal or Algal) Growth or Soil and Dirt Accumulation.

C. Gypsum Association (GA):
1. GA-214 - Levels of Gypsum Board Finish.
2. GA-216 - Application and Finishing of Gypsum Board.
3. GA-600 - Fire Resistance and Sound Control Design Manual.

D. Steel Stud Manufacturer's Assocation (SSMA)
1. Member listing

1.3 SUBMITTALS

A. Product Data: Provide product data for framing members.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in the installation of light gage metal framing components and gypsum wallboard with minimum 5 years documented experience.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Section 01600 - Product Requirements: Transport, handle, store, and protect products.

B. Protect metal framing from corrosion, deformation, and other damage during delivery, storage, and handling.

C. Store and protect metal framing with weatherproof covering, and ventilate to avoid condensation.

D. Deliver materials in original packages, containers, or bundles bearing brand name and identification of manufacturer or supplier.

E. Stack gypsum board flat to prevent sagging.

1.6 PROJECT CONDITIONS OR SITE CONDITIONS

A. Environmental Requirements:
1. Establish and maintain environmental conditions for applying and finishing gypsum board in conformance with GA-216.

PART 2 - PRODUCTS

2.1 FRAMING MATERIALS

A. Manufacturer: Subject to compliance with requirements, provide products of one of the following:
1. Dietrich Metal Framing.
2. The Steel Network.
3. Other manufacturers listed as a member of SSMA.

B. Recycled Content of Steel Products: Provide steel framing products with an average recycled content of steel products such that the postconsumer recycled content plus 1/2 of preconsumer recycled content is not less than 25 percent.

C. Interior Nonload-Bearing Partition Framing: ASTM C 645 and C 754; galvanized sheet steel, channel shaped, punched for utility access, depth and gages as indicated below unless otherwise indicated on Drawings.
1. Partition having an unbraced length of 12 feet or Less: Minimum 25 gage (18 mil).
2. Partition having an unbraced length greater than 12 Feet: Minimum 20 gage (30 mil).
3. Partition (bulkheads) suspended from overhead having an unbraced length of 10 Feet or Less: Minimum 25 gage (18 mil).
4. Partition height 8 feet and less: Minimum 25 gage (18 mil).
5. Partition height 8 - 16 feet: Minimum 22 gage (27 mil)
6. Partition height 16 feet and higher: Minimum 20 gage (30 mil).

D. Option: Modified framing members of equivalent thickness for 20 and 25 gage metal such as UltraSTEEL by Dietrich may be used in lieu of traditional framing members.

E. Partition Floor Tracks and Runners: ASTM C 645; galvanized sheet steel, channel shaped, same depth and gage as studs, tight fit; solid web.

F. Furring and Bracing: ASTM C 645; galvanized sheet steel.
1. Studs: ST25 - 2-1/2 inch deep, 25 gage (18 mil).
2. Studs: ST25 - 3-5/8 inch deep, 25 gage (18 mil).
3. Hat-Shaped Channels: 7/8 inch deep x 1-1/2 inch wide, 25 gage (18 mil).
4. Cold-Rolled Channels: 3/4 x 1/2 inch and 1-1/2 x 17/32 inch, 16 gage (54 mil).
5. Z Furring Channel: 1-1/2 inch deep, 25 gage (18 mil).
6. Clip Angles: 2 inches x 2 inches x 16 gage (54 mil) x 1/4 inch less than stud width.
7. Contractor's Option: In leiu of cold rolled channels and clip angles for horizontal wall bridging, Contractor may provide one of the following:
   a. Bridge Bar by the Steel Network.
   b. TradeReady Spazzer 9200 Bridging and Bracing Bar by Dietrich Metal Framing

G. Ceiling Joists, Tracks, Headers at Partition Openings, Framing Attachment Angles, and Fasteners: Specified in Section 05400.

H. Partition Framing Fasteners: Corrosion-resistant self-drilling self-tapping steel screws.
1. 22 Gage (27 mil) Framing: ASTM C 1002; 3/8 inch Type S pan head.
2. 20 Gage (30 mil) and Heavier Framing: ASTM C 954; 5/8 inch Type S-12 low-profile head.

I. Bracing to Framing Attachment Angle Fasteners: #12 diameter pan head corrosion-resistant self-drilling screws.

J. Partition Floor Track Anchorage Device: Low velocity powder-actuated drive pins; minimum 0.138 inch shank diameter x 1-1/2 inch shank length with 7/8 inch diameter washer.
1. Hilti PAT System using X-ZF 37 P8S36 Pins, by Hilti, Tulsa, OK. (800) 879-8000.
2. Ramset/Red Head System using 1500SD Pins, by ITW Ramset/Redhead, Wood Dale, IL (630) 350-0370.

2.2 GYPSUM BOARD MATERIALS

A. Manufacturer: United States Gypsum Company, Chicago, IL. (800) 874-4968.
1. United States Gypsum (USG) gypsum wallboard designations are used within this Section to identify gypsum wallboard and accessory types, unless noted otherwise.
2. Alternate Manufacturers: Subject to compliance with project requirements, unless otherwise specified, gypsum board and accessories equivalent to the USG products specified, by one of the following alternate manufacturers may be provided:
   a. CertainTeed Corp., Tampa, FL. (866) 427-2872.
   b. Georgia-Pacific, Atlanta, GA. (800) 284-5347.
   c. National Gypsum Company, Gold Bond Building Products, Charlotte, NC. (800) 628-4662.
   d. The Steel Network, Raleigh, NC (888) 474-4876. (Accessories only)
   e. Dietrich Metal Framing, Pittsburg, PA (412) 281-2805. (Accessories only)

B. Standard Gypsum Board: Sheetrock, ASTM C 1396; 1/2 inch and 5/8 inch thick, maximum permissible length; ends square cut, tapered edges.

C. Water Resistant Gypsum Board: ASTM C 1396 or C 1658, 1/2 inch thick, maximum permissible lengths; ends square cut, tapered edges. Mold resistance of water resistant gypsum board

shall score a rating of not less than 10 when tested in accordance with ASTM D 3273. Provide the following:

1. Fiberock Brand Aqua-Tough Gypsum Interior Panels by USG

D. Fire Resistant Gypsum Board: Sheetrock Firecode Core, ASTM C 1396, Type X; 5/8 inch thick, maximum permissible lengths; ends square cut, tapered edges; core material as required to comply with Underwriters Laboratories (UL) assemblies indicated on Drawings.

E. Water and Fire Resistant Gypsum Board: Sheetrock Mold Tough Firecode "C" Core or Gold Bond Brand XP Fire-Shield C Gypsum Board, ASTM C 1396, Type X; 5/8 inch thick, maximum permissible lengths; ends square cut, tapered edges, core material as required to comply with Underwriters Laboratories (UL) assemblies indicated on Drawings. Mold resistance of water and fire resistant gypsum board shall score a rating of not less than 10 when tested in accordance with ASTM D 3273.

F. Abuse Resistant Gypsum Board: Panels meeting Soft Body Impact Resistance tested in accordance with ASTM E 696, level 2. 5/8 inch thick. Maximum permissible lengths; ends cut, tapered edges.

G. Gypsum Board Fasteners:
1. Metal Framing: ASTM C 954 and C 1002, Type S-12 bugle head, corrosion-resistant self-drilling self-tapping steel screws.
   a. One Layer 1/2 Inch: 1 inch.
   b. One Layer 5/8 Inch: 1-1/8 inch.
   c. Two Layers: 5/8 Inch: 1-7/8 inch.

H. Wood Furring: ASTM C 1002, 1-1/4 inch, Type W bugle head, corrosion-resistant self-drilling steel screws.

I. Gypsum Board Accessories:
1. Corner Beads: No. 104 Dur-A-Bead galvanized steel corner bead.
2. Edge Trim: Galvanized steel casing.
   a. No. 200-B, L shape for tight abutment at edges.
   b. No. 200-A, J shape at other locations.
3. Control Joint Accessory Piece: No. 093 roll-formed zinc.
4. Vertical Movement Joint Trim: No DRMZ-625-200 aluminum Z shape trim by Fry Reglet.
5. Adhesive: Commercial adhesive complying with ASTM C 557.
6. Acoustical Insulation: Unfaced fiberglass batts specified in Section 07210.
7. Firestopping: Specified in Section 07840 for penetrations of fire-resistive rated gypsum board.

2.3 JOINT TREATMENT MATERIALS

A. General: Comply with ASTM C 475.

B. Joint Tape:
1. Interior Gypsum Wallboard: Paper tape.
2. Exterior Gypsum Soffit Board: Paper tape.
3. Gypsum Sheathing Board: 10/10 grid glass mesh tape.
4. Backer Panels: Glass-Mat Backer Material: 10/10 grid glass mesh tape.

C. Joint Compound
1. Interior Gypsum Wallboard: Sheetrock Ready-Mixed Lightweight All-Purpose Joint Compound with Dust Control.
   a. Substitutions not permitted.
2. Exterior Applications:

a. Exterior Gypsum Soffit Board: Use setting-type taping compound and setting-type, sandable topping compound.
b. Gypsum Sheathing Board: As recommended by sheathing board manufacturer.

3. Backer Panels: Glass-Mat Backer Materials: Use setting-type taping compound as recommended by backer panel manufacturer and that is rated 10 when tested in accordance with ASTM D 3273 and evaluated in accordance with ASTM D 3274.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine existing conditions and adjacent areas where products will be installed and verify that conditions conform to product manufacturer's requirements. Verify that building framing components are ready to receive Work. Verify that rough-in utilities are in-place and located where required. Do not proceed until unsatisfactory conditions have been corrected.

B. Examine panels to assure they are dry and free of moisture and mold damage as evidenced by discoloration, sagging, irregular shape, fuzzy or splotchy surface contamination, and discoloration.

C. Beginning of erection and installation indicates acceptance of existing conditions.

3.2 INSTALLATION - STEEL FRAMING, GENERAL

A. Installation Standards: Comply with ASTM C 754, and ASTM C 840 requirements that apply to framing installation and with further details and instruction by gypsum board manufacturer's written construction guidelines.

B. Install supplementary framing, blocking, and bracing at terminations in gypsum board assemblies to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction. Comply, if none available, with United States Gypsum's "Gypsum Construction Handbook."

3.3 INSTALLATION - PARTITION FRAMING

A. Install studs and fasteners in accordance with manufacturer's published instructions, ASTM C 754, GA-216, and GA-600.

B. Metal Stud Spacing: Unless otherwise noted, provide interior framing at maximum 24 inches on center. Provide 16 inches on center maximum spacing for walls to receive ceramic tile.

C. Align stud web openings horizontally.

D. Splice studs with minimum 8 inch nested lap, fasten each stud flange with minimum two screws.

E. Construct corners using minimum three studs.

F. Double stud at wall openings, door and window jambs, maximum 2 inches from each side of openings.

G. Place studs as indicated on Drawings, minimum 2 inches from abutting walls.

H. Install headers at partition openings using load-bearing C-shaped joists specified in Section 05400.

I. Install framing between studs for attachment of mechanical and electrical items.

J. Install intermediate studs above and below openings to match wall stud spacing.

K. Refer to Drawings for indication of partitions extending to finished ceiling only and for partitions extending through ceiling to building structure above.

L. Maintain clearance under structural members to avoid deflection transfer to studs.
1. Where indicated, construct partition to accommodate vertical deflection.
2. Install optional products by The Steel Network specified in Part 2 above in accordance with manufacturer's printed instruction.
   a. Install clip with step bushing in center of slotted hole.
   b. Use a minimum of two fasteners per clip leg to connect clip to structure and partition framing.
   c. Attach clip to each stud by screwing through the center of each step bushing.

M. Blocking: Screw attach wood blocking between studs. Install blocking for support of plumbing fixtures, toilet partitions, wall cabinets, toilet accessories and hardware.

N. Framing Fastening: Fasten framing in accordance with manufacturer's published instructions and schedule below, unless indicated otherwise on Drawings.

CONNECTION	FASTENER
Floor Track to Concrete	1 - Pin at 32 inches on center.
Partition Stud to Floor Track	1 - Screw each side at each flange.
Stud Brace Web to Stud Web	2 - Screws.
Plates and Straps to Studs	2 - Screws.
Stud Web to Stud Web	2 - Screws.
Stud Brace Web to Attachment Angle	2 - Screws.
Lateral Bracing to Partition Stud Using clip Angles	2 - Screws to stud and 2 - Screws to cold rolled channel.
Runner to Header	1 - Screw at 16 inches on center, maximum 6 inches from each end.

3.4 INSTALLATION - SUSPENDED CEILING

A. Unless otherwise shown, install suspended ceilings in accordance with the following requirements.

B. Suspend ceiling hangers from building structure as follows:
1. Install 1 1/2" cold rolled channels 4'-0" oc with 8 ga hanger wire spaced a max of 4'-0" oc along carrying channels. Attach 7/8” screw furring channels spaced 16" oc perpendicular to the 1 1/2" channel with double strand of saddle tied # 16 ga galvanized tie wire or 1 1/2" furring channel clips. Apply 1/2" gypsum board with its long dimension at right angles to the furring channels. Attach gypsum board with 1" self drilling drywall screws 12" oc in the field of the board 8" or 12" oc at butt joints, located not more than 1/2" from edges.
2. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or ceiling suspension system. Splay hangers only where required to miss obstructions and 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 spacing that interferes with the location of hangers required to support standard

suspension system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards.

4. Secure wire hangers by looping and wire-tying, either directly to structures or to inserts, eyescrews, or other devices and fasteners that are secure and appropriate for substrate, and in a manner that will not cause them to deteriorate or otherwise fail.
5. Do not attach hangers to steel deck tabs.
6. Do not attach hangers to steel roof deck. Attach hangers to structural members.
7. Do not connect or suspend steel framing from ducts, pipes, or conduit.

C. Installation Tolerances: Install steel framing components for suspended ceilings so members for panel attachment are level to within 1/8 inch in 12 feet measured lengthwise on each member and transversely between parallel members.

3.5 INSTALLATION - FURRING

A. Furring Channels:
1. Attach vertically spaced at maximum 16 inches on center, to masonry and concrete surfaces with hammer set or powder driven fasteners staggered 24 inches on center on opposite flanges.
2. Nest channels 8 inches at splices and anchor with 2 fasteners in each wing.

B. Wall Furring:
1. Secure top and bottom runners to structure.
2. Space metal studs at maximum 16 inches on center.
3. Furring for Fire Rating: Install metal furring as required for fire resistance ratings indicated on Drawings, and to GA-600 requirements.

3.6 ACOUSTICAL ACCESSORIES INSTALLATION

A. Place acoustical insulation in partitions tight within spaces, around cut openings, behind and around electrical and mechanical items within or behind partitions, and tight to items passing through partitions as specified in Section 07210.

3.7 INSTALLATION - GYPSUM BOARD

A. Install gypsum board in accordance with manufacturer's published instructions, ASTM C 840, GA-216, and GA-600.
1. Use water resistant gypsum board at wet areas including walls and ceiling in toilet rooms, janitor closets, and food prep areas as applicable and where shown.
2. Use fire resistant gypsum board at locations of fire-resistive rated assemblies indicated on Drawings.
3. Use water and fire resistant gypsum board at locations of fire-resistive rated assemblies where water resistant gypsum board is specified.
4. Use standard gypsum board at locations not indicated to be fire resistant or water resistant type.

B. Where applicable, install ceiling panels before the installation of wall panels.

C. Erect single layer gypsum board in most economical direction, with attachment to firm bearing surfaces over framing members. Do not align panel joints with edges of openings.

D. Treat cut edges, holes, fastener heads, and joints, including those at angle intersections, in water resistant gypsum board and exterior gypsum soffit board with specified joint compound. Treat prior to installation.

E. Place gypsum panels over supporting framing members with panel ends aligning and parallel with framing members. Leave approximately 1/2 inch gap above floor to prevent water and moisture from wicking up gypsum board.

F. Install fasteners from center of field of panel toward ends and edges. Install fasteners 3/8 inch from ends and edges of panels, and as follows:
1. Ceiling: 12 inches on center, perimeter and field.
2. Walls:
   a. Standard: 16 inches on center, perimeter and field.
   b. Water-Resistant: 12 inches on center, perimeter and field.

3.8 JOINT TREATMENT

A. Reinforce interior and exterior corners at ceiling and wall surfaces. Apply 3 inch wide initial coating of joint compound, pressing tape firmly into joint compound. Wipe off excess joint compound. Apply second coat of joint compound with tools of sufficient width to extend beyond joint center, approximately 4 inches. Draw joint compound down to a smooth even plane.

B. After drying or setting, sand or sponge joints, edges, and corners, eliminating high spots and excessive joint compound to produce smooth finish surface. Prepare surfaces to receive subsequent finishes to height of 6 inches above finish ceiling. Feather coats onto adjoining surfaces resulting in maximum camber of 1/32-inch in 12.

C. Sand after second and third applications of joint compound. Do not to raise nap of paper when sanding.

D. Install control joints full height of partition with 1/2 inch gap between board edges and between studs. Control joints shall be installed in accordance with the Gypsum Association GA-234 or the gypsum manufacturer’s recommended guidelines for control joints. Apply sealant at base of joint and control joint accessory piece at face. Install control joints at the following locations:
1. Where a wall or partition runs in an uninterrupted straight plane exceeding 30 linear feet.
2. At pairs of doors, install vertical control joint at each jamb. At single doors, install control joint at latch side of jamb.

E. Place corner beads at external corners. Use longest practical length. Place edge trim where gypsum board abuts dissimilar materials.

3.9 FINISH

A. Apply gypsum board finish in accordance with manufacturer's published instructions and GA-214 Finish Levels.

B. Provide gypsum board finish levels as follows:
1. Level 3 (GA-214): Joints and interior angles have tape embedded in joint compound and one additional coat of joint compound applied over all joints and interior angles and two separate coats of joint compound are applied over joints, angles, fastener heads, and accessories. Surface smooth and free of tool marks and ridges.
2. Level 3: Joints and interior angles have tape embedded in joint compound and two separate coats of joint compound applied over joints, angles, fastener heads, and accessories. Surface smooth and free of tool marks and ridges.

3.10 CONSTRUCTION

A. Interface with Other Work:
1. Coordinate erection of studs with hollow metal door and window frames, sliding window, and overhead coiling door frames.

2. Coordinate installation of anchors, supports, and blocking for mechanical, electrical, and building accessory items installed within framing.

3.11 FIELD QUALITY CONTROL

A. Inspect metal framing erection, placement, spacing, fasteners, and connections to building.

B. Inspect gypsum board installation, fastener type, spacing, and finish level.

C. Inspect installation of firestopping penetrations of fire-restive rated partitions and at voids between top of partition and building structure.

D. Correct deficiencies in Work which inspection indicates are not in compliance with Contract Documents.

END OF SECTION

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. Glazed Ceramic wall tile.
2. Porcelain floor tiles
2. Stone thresholds installed as part of tile installations.

B. Related Sections include the following:
1. Division 3 Section "Cast-in-Place Concrete" for monolithic slab finishes specified for tile substrates.
2. Division 7 Section "Joint Sealants" for sealing of expansion, contraction, control, and isolation joints in tile surfaces.
3. Division 9 Section "Gypsum Board" for cementitious backer units installed in gypsum wallboard assemblies.

1.3 DEFINITIONS

A. Module Size: Actual tile size (minor facial dimension as measured per ASTM C 499) plus joint width indicated.

B. Facial Dimension: Actual tile size (minor facial dimension as measured per ASTM C 499).

C. Facial Dimension: Nominal tile size as defined in ANSI A137.1.

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 0.6.

1.5 SUBMITTALS

A. Product Data: For each type of tile, mortar, grout, and other products specified.

B. Shop Drawings: For the following:
1. Tile patterns and locations.
2. Widths, details, and locations of expansion, contraction, control, and isolation joints in tile substrates and finished tile surfaces.

C. Tile Samples for Initial Selection: Manufacturer's color charts consisting of actual tiles or sections of tiles showing the full range of colors, textures, and patterns available for each type and composition of tile indicated. Include Samples of accessories involving color selection.

D. Grout Samples for Initial Selection: Manufacturer's color charts consisting of actual sections of grout showing the full range of colors available for each type of grout indicated.

E. Samples for Verification: Of each item listed below, prepared on Samples of size and construction indicated. Where products involve normal color and texture variations, include Sample sets showing the full range of variations expected.
   1. Each type and composition of tile and for each color and texture required, at least 12 inches (300 mm) square, mounted on braced cementitious backer units, and with grouted joints using product complying with specified requirements and approved for completed work in color or colors selected by Architect.
   2. Full-size units of each type of trim and accessory for each color required.
   3. Stone thresholds in 6-inch (150-mm) lengths.

F. Master Grade Certificates: For each shipment, type, and composition of tile, signed by tile manufacturer and Installer.

G. Product Certificates: Signed by manufacturers certifying that the products furnished comply with requirements.

H. Qualification Data: For firms and persons specified in the "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names of architects and owners, and other information specified.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced installer who has completed tile installations similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance.

B. Source Limitations for Tile: Obtain each color, grade, finish, type, composition, and variety of tile from one source with resources to provide products from the same production run for each contiguous area of consistent quality in appearance and physical properties without delaying the Work.

C. Source Limitations for Setting and Grouting Materials: Obtain ingredients of a uniform quality for each mortar, adhesive, and grout component from a single manufacturer and each aggregate from one source or producer.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with requirement of ANSI A137.1 for labeling sealed tile packages.

B. Prevent damage or contamination to materials by water, freezing, foreign matter, and other causes.

C. Handle tile with 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.

1.8 PROJECT CONDITIONS

A. Environmental Limitations: Do not install tile until construction in spaces is completed and ambient temperature and humidity conditions are being maintained to comply with referenced

standards and manufacturer's written instructions.

1.9 EXTRA MATERIALS

A. Deliver extra materials to Owner. Furnish extra materials described below that match products installed, are packaged with protective covering for storage, and are identified with labels describing contents.
   1. Tile and Trim Units: Furnish quantity of full-size units equal to 5 percent of amount installed, for each type, composition, color, pattern, and size indicated.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, those indicated in the ceramic tile installation schedules at the end of this Section.

B. Products: Subject to compliance with requirements, provide products indicated in the ceramic tile installation schedules at the end of this Section.

C. 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:

D. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Tile Products:
      a. American Olean Tile Company.
      b. Crossville Ceramics.
      c. Dal-Tile Corporation.
      d. GranitiFiandre.
      e. Quamagra
      f. Cerzmica Vaccari
      g. Niro
      h. Best Tile
      i. Roca Tile USA
   2. Tile-Setting and -Grouting Materials:
      a. American Olean Tile Company.
      b. Dal-Tile Corporation

2.2 PRODUCTS, GENERAL

A. ANSI Ceramic Tile Standard: Provide tile that complies with ANSI A137.1, "Specifications for Porcelain and Ceramic Tile," for types, compositions, and other characteristics indicated.
   1. Provide tile complying with Standard Grade requirements, unless otherwise indicated.
   2. For facial dimensions of tile, comply with requirements relating to tile sizes specified in Part 1 "Definitions" Article.

B. ANSI Standards for Tile Installation Materials: Provide materials complying with ANSI standards referenced in "Setting Materials" and "Grouting Materials" articles.

C. Colors, Textures, and Patterns: Where manufacturer's standard products are indicated for tile,

grout, and other products requiring selection of colors, surface textures, patterns, and other appearance characteristics, provide specific products or materials complying with the following requirements:

1. Provide Architect's selections from manufacturer's full range of colors, textures, and patterns for products of type indicated.

D. Factory Blending: For tile exhibiting color variations within the ranges selected during Sample submittals, blend tile in the factory and package so tile units taken from one package show the same range in colors as those taken from other packages and match approved Samples.

E. Mounting: Where factory-mounted tile is required, provide back- or edge-mounted tile assemblies as standard with manufacturer, unless another mounting method is 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 these kinds of installations and has a record of successful in-service performance.

F. Factory-Applied Temporary Protective Coating: Where indicated under tile type, protect exposed surfaces of tile against adherence of mortar and grout by precoating them with a continuous film of petroleum paraffin wax, applied hot. Do not coat unexposed tile surfaces.

2.3 TILE PRODUCTS

A. Porcelain Floor Tile: Provide square-edged flat tile complying with the following requirements:

1. Wearing Surface: Abrasive aggregate embedded in surface.
2. Facial Dimensions: Selected and approved by Architect from the options below. Final sizes will be determined after receipt and review of the samples per submittals in Part 1 above.
   a. 12” x 12” (304.8mm by 304.8 mm).
   b. 6” x 6” (152.4mm by 152.4mm).
3. Thickness: 3/8 inch (9.5 mm).
4 Face: Pattern of design indicated.

B. Glazed Wall Tile: Provide flat tile complying with the following requirements:

1. Module Size: Selected and approved by Architect from the options below. Final sizes will be determined after receipt and review of the samples per submittals in Part 1 above.
   a. 12” x 12” (304.8mm by 304.8 mm).
   b. 6” x 6” (152.4mm by 152.4mm).
   c. 4-1/4 by 4-1/4 inches (114.3 by 114.3 mm).
2. Thickness: 5/16 inch (8 mm).
3. Face: Plain with modified square edges or cushion edges.
4. Mounting: Factory back-mounted.

C. Trim Units: Provide tile trim units to match characteristics of adjoining flat tile and to comply with the following requirements:

1. Size: Available sizes per manufacturer’s standards, coordinated with sizes and coursing of adjoining flat tile where applicable.
2. Shapes: As follows, selected from manufacturer's standard shapes:
   a. Base for Thin-Set Mortar Installations: Straight.

2.4 STONE THRESHOLDS

A. General: Provide stone thresholds that are uniform in color and finish, fabricated to sizes and

profiles indicated to provide transition between tile surfaces and adjoining finished floor surfaces.

1. Fabricate thresholds to heights indicated, but not more than 1/2 inch (12.7 mm) above adjoining finished floor surfaces, with transition edges beveled on a slope of no greater than 1:2.

B. Marble Thresholds: Provide marble thresholds complying with ASTM C 503 requirements for exterior use and with a minimum abrasive-hardness value of 10 per ASTM C 241.

1. Provide white, honed marble complying with the Marble Institute of America's Group A requirements for soundness.

2.5 WATERPROOFING FOR THIN-SET TILE INSTALLATIONS

A. General: Provide products that comply with ANSI A118.10 and the descriptions in this Article.

B. Urethane Waterproofing and Tile-Setting Adhesive: Manufacturer's standard proprietary product consisting of 1-part liquid-applied urethane in a consistency suitable for trowel application and intended for use as both waterproofing and tile-setting adhesive in a 2-step process.

C. Available Products: Subject to compliance with requirements, products which may be incorporated into the Work include, but are not limited to, the following:

2.6 SETTING MATERIALS

A. Portland Cement Mortar Installation Materials: Provide materials complying with ANSI A108.1A and as specified below:

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: Provide diamond-mesh lath complying with ASTM C 847 for requirements indicated below:
    a. Base Metal and Finish for Interior Applications: Fabricate lath from uncoated or zinc-coated (galvanized) steel sheet, with uncoated steel sheet painted after fabrication into lath.
    b. Base Metal and Finish for Exterior Applications: Fabricate lath from 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).
    f. Weight: 3.4 lb/sq. yd. (1.8 kg/sq. m).
4. Latex additive (water emulsion) described below, serving as replacement for part or all of gaging water, of type specifically recommended by latex additive manufacturer for use with job-mixed portland cement and aggregate mortar bed.
    a. Latex Additive: Manufacturer's standard.
    b. Latex Additive: Styrene butadiene rubber.
    c. Latex Additive: Acrylic resin.

2.7 GROUTING MATERIALS

A. Commercial Portland Cement Grout (Sanded Grout): ANSI A118.6, color as indicated, for joints 1/8 inch (3.2 mm) or wider.

2.8 ELASTOMERIC SEALANTS

A. General: Provide manufacturer's standard chemically curing, elastomeric sealants of base polymer and characteristics indicated that comply with applicable requirements of Division 7 Section "Joint Sealants."

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 temperature extremes.

2.9 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: White-zinc-alloy terrazzo strips, 1/8 inch (3.2 mm) wide at top edge with integral provision for anchorage to mortar bed or substrate, unless otherwise indicated.

C. Temporary Protective Coating: Provide product indicated below that is formulated to protect exposed surfaces of tile against adherence of mortar and grout; is compatible with tile, mortar, and grout products; and is 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 a 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.

2.10 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 from oil, waxy films, and curing compounds; and within flatness tolerances required by referenced ANSI A108 series of tile installation standards for installations indicated.
2. 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 before installing tile.
3. Verify that joints and cracks in tile substrates are coordinated with tile joint locations; if not coordinated, adjust latter in consultation with Architect.

B. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Remove coatings, including curing compounds, and other substances that contain soap, wax, oil, or silicone and are incompatible with tile-setting materials by using a terrazzo or concrete grinder, a drum sander, or a polishing machine equipped with a heavy-duty wire brush.

B. Provide concrete substrates for tile floors installed with dry-set or latex-portland cement mortars that comply with flatness tolerances specified in referenced ANSI A108 series of tile installation standards for installations indicated.
1. Use trowelable leveling and patching compounds per tile-setting material manufacturer's written instructions to fill cracks, holes, and depressions.
2. Remove protrusions, bumps, and ridges by sanding or grinding.

C. Blending: For tile exhibiting color variations within the ranges selected during Sample submittals, verify that tile has been blended in the factory and packaged so tile units taken from one package show the same range in 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: Where indicated under tile type or needed to prevent adhesion or staining of exposed tile surfaces by grout, protect exposed surfaces of tile against adherence of mortar and grout by precoating them with a continuous film of temporary protective coating indicated below, taking care not to coat unexposed tile surfaces:
1. Petroleum paraffin wax, applied hot.
2. Grout release.
3. Petroleum paraffin wax or grout release.

3.3 INSTALLATION, GENERAL

A. ANSI Tile Installation Standards: Comply with parts of ANSI A108 series of tile installation standards in "Specifications for Installation of Ceramic Tile" that apply to types of setting and grouting materials and to methods indicated in ceramic tile installation schedules.

B. TCA Installation Guidelines: TCA's "Handbook for Ceramic Tile Installation." Comply with TCA installation methods indicated in ceramic tile installation schedules.

C. Extend tile work into recesses and under or behind equipment and fixtures to form a complete

covering without interruptions, unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.

D. 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.

E. Jointing Pattern: Lay tile in grid pattern, unless otherwise indicated. Align joints when adjoining tiles on floor, base, walls, and trim are the same size. Lay out tile work and center tile fields in both directions in each space or on each wall area. Adjust to minimize tile cutting. Provide uniform joint widths, unless otherwise indicated.
1. For tile mounted in sheets, make joints between tile sheets the same width as joints within tile sheets so joints between sheets are not apparent in finished work.

F. Expansion Joints: Locate expansion joints and other sealant-filled joints, including control, contraction, and isolation joints, where indicated during installation of setting materials, mortar beds, and tile. Do not saw-cut joints after installing tiles.
2. Locate joints in tile surfaces directly above joints in concrete substrates.
3. Prepare joints and apply sealants to comply with requirements of Division 7 Section "Joint Sealants."

G. Grout tile to comply with the requirements of the following tile installation standards:
1. For ceramic tile grouts (sand-portland cement, dry-set, commercial portland cement, and latex-portland cement grouts), comply with ANSI A108.10.

F. At showers, tubs, and where indicated, install cementitious backer units and treat joints to comply with ANSI A108.11 and manufacturer's written instructions for type of application indicated.

3.4 WATERPROOFING INSTALLATION

A. Install waterproofing to comply with waterproofing manufacturer's written instructions to produce a waterproof membrane of uniform thickness bonded securely to substrate.

3.5 FLOOR TILE INSTALLATION

A. General: Install tile to comply with requirements in the Ceramic Tile Floor Installation Schedule, including those referencing TCA installation methods and ANSI A108 series of tile installation standards.

B. Joint Widths: Install tile on floors with the following joint widths:
1. Porcelain Tile: 1/4 inch (6.35 mm).

C. Back Buttering: For installations indicated, obtain 100 percent mortar coverage by complying with applicable special requirements for back buttering of tile in referenced ANSI A108 series of tile installation standards:
1. Tile floors in wet areas, including showers.
2. Tile floors composed of tiles 8 by 8 inches (203 by 203 mm) or larger.
3. Tile floors composed of rib-backed tiles.

D. Stone Thresholds: Install stone thresholds at locations indicated; set in same type of setting bed as abutting field tile, unless otherwise indicated.

1. Set thresholds in latex-portland cement mortar for locations where mortar bed would otherwise be exposed above adjacent nontile floor finish.

3.6 WALL TILE INSTALLATION

A. Install types of tile designated for wall installations to comply with requirements in the Ceramic Tile Wall Installation Schedule, including those referencing TCA installation methods and ANSI setting-bed standards.

B. Install metal lath and scratch coat to walls to comply with ANSI A108.1A, Section 4.1.

C. Joint Widths: Install tile on walls with the following joint widths:
2. Ceramic Mosaic Tile: 1/8 inch (1.6 mm).
3. Wall Tile: 1/8 inch (1.6 mm).

D. Back Buttering: For installations indicated, obtain 100 percent mortar coverage by complying with applicable special requirements for back buttering of tile in referenced ANSI A108 series of tile installation standards:
1. Tile wall installations in wet areas, including showers, tub enclosures, laundries, and swimming pools.

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 latex-portland cement grout residue from tile as soon as possible.
2. Unglazed tile may be cleaned with acid solutions only when permitted by tile and grout manufacturer's written instructions, but no sooner than 10 days after installation. Protect metal surfaces, cast iron, and vitreous plumbing fixtures from effects of acid cleaning. Flush surface with clean water before and after cleaning.
3. Remove temporary protective coating by method recommended by coating manufacturer that is acceptable to brick and grout manufacturer. Trap and remove coating to prevent it from clogging drains.

B. Finished Tile Work: Leave finished installation clean and free of cracked, chipped, broken, unbonded, and otherwise defective tile work.

C. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure tile is without damage or deterioration at the time of Substantial Completion.
1. When recommended by tile manufacturer, apply a protective coat of neutral protective cleaner to completed tile walls and floors. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear.
2. Prohibit foot and wheel traffic from tiled floors for at least 7 days after grouting is completed.

D. Before final inspection, remove protective coverings and rinse neutral cleaner from tile surfaces.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY:

A. Work of this section includes installation of two types of epoxy flooring with integral base where indicated on drawings.

1.2 SUBMITTALS:

A. Product data: Submit manufacturer's data and application instructions. Include statement that installed flooring will comply with non-slip properties specified.

B. Samples: Submit 6" by 6" samples for Architect's selection showing non-slip finish and manufacturer's standard colors, applied to rigid backing.

1. For initial selection of colors and finishes, submit manufacturer's color charts showing full range of colors and finishes available.

C. Manufacturer's detailed maintenance and care instructions.

1.3 QUALITY ASSURANCE:

A. Applicable standards; standards of the following, as referenced herein:

1. American Society for Testing and Materials (ASTM).
2. American National Standards Institute (ANSI).

B. Installer and manufacturer qualifications:

1. Installer: Trained and approved in writing by flooring system manufacturer.
2. Manufacturer: Minimum five years of production and installation of specified system.
3. Products: System components furnished by same manufacturer.

C. Pre-Installation Conference:

1. General contractor shall arrange a meeting not less than thirty days prior to starting work.
2. Attendance:
   a. General Contractor.
   b. Architect.
   c. Manufacturer / Installer Representative.

1.4 DELIVERY, STORAGE AND HANDLING:

A. Deliver materials to project site in manufacturer's unopened

B. All materials used shall be factory pre-weighed and pre-containers with labels intact packaged in single, easy to manage batches to eliminate on site mixing errors. No on site weighting or volumetric measurements allowed.

C. Material shall be stored in a dry, enclosed area protected from exposure to moisture. Temperature of storage area shall be maintained between 60 and 85 degree F/16 and 30 degree C.

D. Store materials indoors; protect from contamination.

1.5 PROJECT/SITE CONDITIONS:

A. Environmental requirements: Work of other trades shall be complete in installation area, to eliminate dust, dirt, damage or other deleterious conditions during installation of flooring. Maintain temperature before, during and after installation until flooring is cured, at a temperature range as recommended by flooring manufacturer's product data.

B. Provide controlled ventilation in spaces being floored. Maintain ventilation throughout curing period.

C. Coordination: Coordinate requirements for special finishing and curing of concrete floor slabs with requirements of Division 3, minimum of 30 days.

D. Job area to be free of other trades during, and for a period of 24 hours, after floor installation.

1.6 WARRANTIES:

A. Installer and flooring manufacturer shall jointly warranty flooring material and application for a period of three years, for its normal and intended use; should flooring need repair or replacement, Owner will incur no cost for repair or replacement. Warranty shall begin on Date of Substantial Completion.

PART 2 - PRODUCTS

2.1 DECORATIVE SEAMLESS EPOXY FLOORING:

A. Acceptable manufacturers, subject to compliance with specified requirements:
1. Basis of design: Palma, Inc., PaliKrom 125.
2. Stonhard, Inc.
3. Dexotex, Div. of Crossfield Products Corp.
4. General Polymers Corp.
5. Selby, Div. of Degussa Building Systems.
6. Tnemec Co., Inc.

B. Characteristics:
1. Type: Self-leveling epoxy floor system consisting of a penetrating membrane bodycoat primer, colored quartz silica aggregate, and clear epoxy grout coat sealer topcoat; with integral base.
2. Thickness: 1/8" (125 mils).
3. Integral base: 8" high base.
4. Colors: Two bright colors, as selected by Architect from manufacturer's standard colors.

C. Physical properties:
1. Flammability: Self extinguishing hen tested in accord with ASTM D635-98, extent of burning 0.25 inches maximum.
2. Hardness: 83 average when tested in accord with ASTM D2240-02b, Shore D.
3. Water absorption: 0.37% when tested in accord with ASTM C413-01.
4. Abrasion resistance: 0.05 gm maximum weight loss when tested in accord with ASTM D4060-01, taber abrader CS-17 wheel.
5. Impact resistance: Maximum 10 Mils without cracking, delamination or chipping

when tested in accord with MIL-D3134.

6. Compressive strength: 13,500 psi minimum when tested in accord with ASTM 579-01.
7. Tensile strength: 1,790 psi minimum when tested in accord with ASTM C307-99.
8. Flexural strength: 5,030 psi minimum when tested in accord with ASTM C580-02.
9. Coefficient of friction: 0.89 when tested in accord with ASTM D2047-99.
10. Thermal coefficient of expansion: 1.9 x 10' when tested in accord with ASTM 531-00, in/in/degree C.
11. Bond strength: >535 psi when tested in accord with ASTM D4541-02 (100% concrete failure).
12. Flexural modulus of elasticity: 7.03 by 106 psi when tested in accord with ASTM C580-02.
13. Cure rate: Allow 16 hours for light traffic, and 24
14. Heat resistance limitation: 140 degrees F / 60 Heat resistance limitation: 140 degrees F /60 Heat resistance limitation: 140 degrees F / 60 degrees C (for continuous exposure).

D. Accessory materials: Provide primers, sealers and other accessories as required.

PART 3 - EXECUTION

3.1 EXAMINATION:

A. Perform bond and moisture tests on subfloors in accord with ASTM F2170-02 and epoxy flooring manufacturer's product data to determine if surfaces are acceptable to receive specified epoxy flooring products. Correct conditions detrimental to epoxy flooring installation prior to starting installation.

B. Concrete surfaces to receive flooring shall have a smooth light steel trowel finish, within tolerances specified in Concrete section and cured with compounds acceptable as substrate for flooring system in accord with epoxy flooring system manufacturer's product data.

C. Concrete surfaces to receive flooring shall be free of dust, dirt, laitance, grease and other materials deleterious to proper bonding of flooring to substrates.

3.2 PREPARATION:

A. Prior to application of prime coat, clean surfaces to receive flooring. Remove debris, dirt and foreign substances.

B. Patch cracks and other imperfections in substrates in accord with epoxy flooring system manufacturer's product data.

C. Maintain slopes to drains in repair areas. Determine any deviations to the uniformly sloped concrete substrates by either of the following methods:

1. Flood floor and mark residual puddles greater than 1/16" deep.
2. Use a 10'-0" metal straightedge and mark variations greater than 1/16".
3. Submit, in writing, a proposal for correcting any unsatisfactory conditions found from the above method(s) to the Architect.
4. Ensure that no ponding occurs in finished flooring system.

3.3 INSTALLATION OF EPOXY FORMULATION:

A. Apply flooring material in accord with manufacturer's product data. Rate of application shall not be less than recommended by manufacturer's product data.

B. Extend flooring material up wall surface to form integral coved base. Bond directly to wall surfaces. Bases in wet areas shall be free of seams which could allow water to enter substrate.

C. Primer: Mix and apply primer over properly prepared substrate with strict adherence to manufacturer's installation procedures and coverage rates.

D. Broadcast: Immediately broadcast quartz silica aggregate into the primer using manufacturer's specially designed spraycaster. Strict adherence to manufacturer's installation procedures and coverage rates is imperative.

E. Sealer: Remove excess unbonded granules by lightly brushing and vacuuming the floor surface. Mix and apply sealer with strict adherence to manufacturer's installation procedures.

F. Cure flooring for period recommended by manufacturer's product data before allowing traffic on surface.

G. Completed flooring shall be uniform in color, texture and aggregate distribution. Surface shall be in place and uniform and free of bubbles, foreign material, defect or irregularity. Trim edges and where material abuts adjacent construction. Edges at doors shall occur under closed door.

H. At terminations and doorways, sawcut concrete and chisel out to provide proper termination of flooring material; no featheredges allowed.

I. If slope between high points is found to be inadequate, correct slope to achieve proper runoff.

J. Site tolerances:

1. Finished floor shall be level and true to line in an undivided space: +1/4"; maximum +1/16" in a running foot.
2. No water shall stand between high point and low point (floor drain) on finished product.

3.4 CLEANING AND PROTECTION

A. During installation of a floor, do not allow foreign materials to enter floor drains. Leave drain covers and cleanouts loose, clean and accessible. Do not smear walls, columns, machinery or furniture with epoxy or other materials. Clean up aggregate and resins that are residuals to topping system.

END OF SECTION

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 ceilings composed of acoustical panels and exposed suspension systems.

1.3 SUBMITTALS

A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.

B. Product data for each type of product specified to match existing in area of replacement

C. Coordination drawings for reflected ceiling plans drawn accurately to scale and coordinating penetrations and ceiling-mounted items. Show the following:
1. Ceiling suspension system members.
2. Method of attaching suspension system hangers to building structure.
3. Ceiling-mounted items including light fixtures; air outlets and inlets; speakers; sprinklers; and special moldings at walls, column penetrations, and other junctures of acoustical ceilings with adjoining construction.
4. Minimum Drawing Scale: 1/8 inch = 1 foot.

D. Samples for initial selection in the form of manufacturer's color charts consisting of actual acoustical panels or sections of panels and sections of suspension system members showing the full range of colors, textures, and patterns available for each ceiling assembly indicated.

E. Samples for verification of each type of exposed finish required, prepared on samples of size indicated below. Where finishes involve normal color and texture variations, include sample sets showing the full range of variations expected.
1. 6-inch- (150-mm-) square samples of each acoustical panel type, pattern, and color.
2. Full-size samples of each acoustical panel type, pattern, and color.
3. Set of 12-inch- (300-mm-) long samples of exposed suspension system members, including moldings, for each color and system type required.

F. Qualification data for firms and persons specified in the "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

G. Product test reports from a qualified independent testing agency that are based on its testing of current products for compliance of acoustical panel ceilings and components with requirements.

H. Research reports or evaluation reports of the model code organization acceptable to authorities having jurisdiction that show compliance of acoustical panel ceilings and components with the building code in effect for the Project.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced Installer who has completed acoustical panel ceilings similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance.

B. Fire-Test-Response Characteristics: Provide acoustical panel ceilings that comply with the following requirements:
   1. Fire-response tests are performed by a qualified testing and inspecting agency. Qualified testing and inspecting agencies include Underwriters Laboratories (UL), Warnock Hersey, or another agency that is acceptable to authorities having jurisdiction and that performs testing and follow-up services.
   2. Surface-burning characteristics of acoustical panels comply with ASTM E 1264 for Class A materials as determined by testing identical products per ASTM E 84.
   3. Acoustical panel ceilings indicated are identical in materials and construction to those tested for fire resistance per ASTM E 119.
   4. Fire-resistance-rated, acoustical panel ceilings are indicated by design designations listed in the UL "Fire Resistance Directory," in the Warnock Hersey "Certification Listings," or in the listing of another qualified testing and inspecting agency.
   5. Products are identified with appropriate markings of applicable testing and inspecting agency.

C. Single-Source Responsibility for Ceiling Units: Obtain each type of acoustical ceiling panel from a single source with resources to provide products of consistent quality in appearance and physical properties without delaying the Work.

D. Single-Source Responsibility for Suspension System: Obtain each type of suspension system from a single source with resources to provide products of consistent quality in appearance and physical properties without delaying the Work.
   1. Obtain both acoustical panels and suspension system from the same manufacturer.

E. Preinstallation Conference: Conduct conference at Project site to comply with requirements of Division 1 Section "Project Meetings."

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver acoustical panels and suspension system components to Project site in original, unopened packages and store them in a fully enclosed space where they will be protected against damage from moisture, direct sunlight, surface contamination, and other causes.

B. Before installing acoustical panels, permit them to reach room temperature and a stabilized moisture content.

C. Handle acoustical panels carefully to avoid chipping edges or damaging units in any way.

1.6 PROJECT CONDITIONS

A. Space Enclosure and Environmental Limitations: Do not install acoustical panel ceilings until spaces are enclosed and weatherproof, wet-work in spaces is completed and dry, work above ceilings is complete, and ambient temperature and humidity conditions are being maintained at the levels indicated for Project when occupied for its intended use.

1.7 COORDINATION

A. Coordinate layout and installation of acoustical panels and suspension system components with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system components (if any), and partition assemblies (if any).

1.8 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed, are packaged with protective covering for storage, and are identified with labels clearly describing contents.
   1. Acoustical Ceiling Units: Furnish quantity of full-size units equal to 2.0 percent of amount installed.
   2. Exposed Suspension System Components: Furnish quantity of each exposed component equal to 2.0 percent of amount installed.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Products: Subject to compliance with requirements, acoustical panels that may be incorporated in the Work include, but are not limited to, the following:

B. Products: Subject to compliance with requirements, provide one of the following for each panel type indicated or approved equivalent:
   1. ACT#1 Non-Fire-Resistance-Rated, Water-Felted, Mineral-Base Panels. Sizes as shown. Provide one of the following:
      a. Radar Auratone Omni Fissured: USG Interiors, Inc.
      b. Minaboard Cortega; Armstrong World Industries, Inc.
      c. Acoustic–Tough Ceiling System; Soft Look Tunico, Tectum, Inc.
   2. ACT#2 Fire-Resistance-Rated, Water-Felted, Mineral-Base Panels. Sizes as shown. Provide one of the following:
      a. Radar Auratone Fire Code Omni Fissured; USG Interiors, Inc.
      b. Fire Guard Cortega; Armstrong World Industries, Inc.
   3. ACT#3 Non-Fire-Resistance-Rated, square edge, non-perforated, vinyl faced gypsum which satisfy USDA/FSIS guidelines for sanitary applications. Sizes as shown. Provide one of the following:
      a. VinylRock by Certain Teed.
      b. Sheetrock Lay-in Celing Panel ClimaPlus by USG
      c. Grinstone Brand Gypsum Ceiling Panels by National Gypsum

C. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the products specified in each Acoustical Panel Ceiling Product Data Sheet at the end of this Section.

D. Products: Subject to compliance with requirements, provide one of the products specified in each Acoustical Panel Ceiling Product Data Sheet at the end of this Section.

2.2 ACOUSTICAL PANELS, GENERAL

A. Acoustical Panel Standard: Provide manufacturer's standard panels of configuration indicated that comply with ASTM E 1264 classifications as designated by types, patterns, acoustical ratings, and light reflectances, unless otherwise indicated.
   1. Mounting Method for Measuring Noise Reduction Coefficient (NRC): Type E-400 per ASTM E 795.
   2. Test Method for Ceiling Attenuation Class (CAC): Where acoustical panel ceilings are specified to have a CAC, provide units identical to those tested per ASTM E 1414 by a qualified testing agency.

B. Acoustical Panel Colors and Patterns: Match appearance characteristics indicated for each product type.
   1. Where appearance characteristics of acoustical panels are indicated by reference to ASTM E 1264 pattern designations and not to manufacturers' proprietary product designations, provide products selected by Architect from each manufacturer's full range of products that comply with requirements indicated for type, pattern, color, light reflectance, acoustical performance, edge detail, and size.

C. Panel Characteristics: Comply with requirements indicated on each Acoustical Panel Ceiling Product Data Sheet at the end of this Section, including those referencing ASTM E 1264 classifications.

2.3 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 ASTM C 635 requirements.

B. Finishes and Colors: Provide manufacturer's standard factory-applied finish for type of system indicated.
   1. High-Humidity Finish: Comply with ASTM C 635 requirements for "Coating Classification for Severe Environment Performance" where high-humidity finishes are indicated.

C. Attachment Devices: Size for 5 times the design load indicated in ASTM C 635, Table 1, Direct Hung unless otherwise indicated.

D. Wire Hangers, Braces, and Ties: Provide wires complying with the following requirements:
   1. Zinc-Coated Carbon Steel Wire: ASTM A 641 (ASTM A 641M), Class 1 zinc coating, soft temper.
   2. Nickel-Copper Alloy Wire: ASTM B 164, nickel-copper alloy UNS N04400.
   3. Size: Select wire diameter so that its stress at 3 times the hanger design load (ASTM C 635, Table 1, Direct Hung) will be less than the yield stress of wire, but provide not less than 0.106-inch- (2.69-mm-) diameter wire.

E. Hanger Rods: Mild steel, zinc coated, or protected with rust-inhibitive paint.

F. Flat Hangers: Mild steel, zinc coated, or protected with rust-inhibitive paint.

G. Angle Hangers: Angles with legs not less than 7/8 inch (22 mm) wide, formed with 0.0396-inch- (1-mm-) thick galvanized-steel sheet complying with ASTM A 446, G 90 (ASTM A 446M, Z 275) Coating Designation, with bolted connections and 5/16-inch- (8-mm-) diameter bolts.

H. Sheet-Metal Edge Moldings and Trim: Type and profile indicated, or if not indicated, manufacturer's standard moldings for edges and penetrations that fit acoustical panel edge details and suspension systems indicated; formed from sheet metal of same material and finish as that used for exposed flanges of suspension system runners.
   1. For lay-in panels with reveal edge details, provide stepped-edge molding that forms reveal of same depth and width as that formed between edge of panel and flange at exposed suspension member.
   2. For circular penetrations of ceiling, provide edge moldings fabricated to diameter required to fit penetration exactly.
   3. For narrow-face suspension systems, provide suspension system and manufacturer's standard edge moldings that match width and configuration of exposed runners.

I. Hold-Down Clips for Non-Fire-Resistance-Rated Ceilings: For interior ceilings composed of acoustical panels weighing less than 1 lb per sq. ft. (4.88 kg per sq. m), provide hold-down clips spaced 24 inches (610 mm) o.c. on all cross tees.

J. Impact Clips: Where indicated, provide manufacturer's standard impact-clip system design to absorb impact forces against acoustical panels.

2.4 NON-FIRE-RESISTANCE-RATED, DIRECT-HUNG SUSPENSION SYSTEMS

A. Wide-Face, Single-Web, Steel Suspension System: Main and cross runners roll formed from prepainted or electrolytic zinc-coated, cold-rolled steel sheet, with prepainted 15/16-inch- (24-mm-) wide flanges; other characteristics as follows:
   1. Structural Classification: Intermediate-duty system.
   2. Finish: Painted white.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and structural framing to which acoustical panel ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Measure each ceiling area and establish the layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders, and conform to the layout shown on reflected ceiling plans.

3.3 INSTALLATION

A. General: Install acoustical panel ceilings to comply with publications referenced below per manufacturer's instructions and CISCA "Ceiling Systems Handbook."
   1. Standard for Ceiling Suspension System Installations: Comply with ASTM C 636.
   2. Standard for Ceiling Suspension Systems Requiring Seismic Restraint: Comply with ASTM E 580.
   3. CISCA Recommendations for Acoustical Ceilings: Comply with CISCA "Recommendations

for Direct-Hung Acoustical Tile and Lay-In Panel Ceilings."

4. CISCA Guidelines for Systems Requiring Seismic Restraint: Comply with CISCA "Guidelines for Seismic Restraint of Direct-Hung Suspended Ceiling Assemblies."
5. U.B.C. Standard for Ceiling Suspension Systems: U.B.C. Standard No. 47-18.

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 the supporting structure or of the ceiling suspension system.
2. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
3. Splay hangers only where required, and if permitted with fire-resistance-rated ceilings, to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
4. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with the location of hangers at spacings required to support standard suspension system members, install supplemental suspension members and hangers in the form of trapezes or equivalent devices. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.
5. Secure wire hangers to ceiling suspension members and to supports above with a minimum of 3 tight turns. Connect hangers either directly to structures or to inserts, eye screws, or other devices that are secure, that are appropriate for substrate, and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
6. Secure flat, angle, channel, and rod hangers to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices that are secure and appropriate for both the structure to which hangers are attached and the type of hanger involved. Install hangers in a manner that will not cause them to deteriorate or fail due to age, corrosion, or elevated temperatures.
7. Secure bracing wires to ceiling suspension members and to supports with a minimum of 4 tight turns. Fasten bracing wires to concrete with cast-in-place or postinstalled anchors.
8. Do not support ceilings directly from permanent metal forms. Fasten hangers to cast-in-place hanger inserts, powder-actuated fasteners, or drilled-in anchors that extend through forms into concrete.
9. Do not attach hangers to steel deck tabs.
10. Do not attach hangers to steel roof deck. Attach hangers to structural members.
11. Space hangers not more than 48 inches (1200 mm) o.c. along each member supported directly from hangers, unless otherwise shown; and provide hangers not more than 8 inches (200 mm) from ends of each member.

C. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels.
1. Apply acoustical sealant in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.
2. Screw attach moldings to substrate at intervals not over 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 (3.18 mm in 3.66 m). Miter corners accurately and connect securely.
3. Do not use exposed fasteners, including pop rivets, on moldings and trim.

D. Install suspension system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.

E. Install acoustical panels with undamaged edges and fitted accurately into suspension system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide neat, precise fit.
   1. Arrange directionally patterned acoustical panels as follows:
      a. In the manner indicated on reflected ceiling plans.
      b. Install panels with pattern running in one direction parallel to long axis of space.
      c. Install panels with pattern running in one direction parallel to short axis of space.
      d. Install panels in a basket-weave pattern.
   2. For square-edged panels, install panels with edges fully hidden from view by flanges of suspension system runners and moldings.
   3. For reveal-edged panels on suspension system runners, install panels with bottom of reveal in firm contact with top surface of runner flanges.
   4. For reveal-edged panels on suspension system members with box-shaped flanges, install panels with reveal surfaces in firm contact with suspension system surfaces and panel faces flush with bottom face of runners.
   5. Paint the cut panel edges remaining exposed after installation; match color of exposed panel surfaces using coating recommended for this purpose by acoustical panel manufacturer.
   6. Install hold-down clips in areas indicated and in areas required by governing regulations, or for fire-resistance ratings; space as recommended by panel manufacturer, unless otherwise indicated or required.
   7. Protect lighting fixtures and air ducts to comply with requirements indicated for fire-resistance-rated assembly.

3.4 CLEANING

A. Clean exposed surfaces of acoustical panel ceilings, including trim, edge moldings, and suspension system members. Comply with manufacturer's instructions for cleaning and touchup of minor finish damage. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION

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 surface preparation and field painting of the following:
1. Exposed exterior items and surfaces.
2. Exposed interior items and surfaces.
3. Surface preparation, priming, and finish coats specified in this Section are in addition to shop priming and surface treatment specified in other Sections.

B. Paint exposed surfaces, except where the paint schedules indicate that a surface or material is not to be painted or is to remain natural. If the paint schedules do not specifically mention an item or a surface, paint the item or surface the same as similar adjacent materials or surfaces whether or not schedules indicate colors. If the schedules do not indicate color or finish, the Architect will select from standard colors and finishes available.
1. Painting includes field painting of exposed bare and covered pipes and ducts (including color coding), hangers, exposed steel and iron work, and primed metal surfaces of mechanical and electrical equipment.

C. Do not paint prefinished items, concealed surfaces, finished metal surfaces, operating parts, and labels.
1. Prefinished items include the following factory-finished components:
   a. Architectural woodwork and casework.
   b. Acoustical wall panels.
   c. Metal toilet enclosures.
   d. Elevator entrance doors and frames.
   e. Elevator equipment.
   f. Finished mechanical and electrical equipment.
   g Light fixtures.
   h. Distribution cabinets.
2. Concealed surfaces include walls or ceilings in the following generally inaccessible spaces:
   a. Foundation spaces.
   b. Furred areas.
   c. Ceiling plenums.
   d. Utility tunnels.
   e. Pipe spaces.
   f. Duct shafts.
   g. Elevator shafts.
3. Finished metal surfaces include the following:
   a. Anodized aluminum.
   b. Stainless steel.
   c. Chromium plate.
   d. Copper.
   e. Bronze and brass.
4. Operating parts include moving parts of operating equipment and the following:
   a. Valve and damper operators.

b. Linkages.
c. Sensing devices.
d. Motor and fan shafts.

5. Labels: Do not paint over Underwriters Laboratories (UL), Factory Mutual (FM), or other code-required labels or equipment name, identification, performance rating, or nomenclature plates.

D. Related Sections include the following:
1. Division 5 Section "Metal Fabrications" for shop priming ferrous metal.
2. Division 8 Section "Steel Doors and Frames" for shop priming steel doors and frames.
3. Division 9 Section "Gypsum Board Assemblies" for surface preparation for gypsum board.

1.3 DEFINITIONS

A. General: Standard coating terms defined in ASTM D 16 apply to this Section.
1. Flat refers to a lusterless or matte finish with a gloss range below 15 when measured at an 85-degree meter.
2. Eggshell refers to low-sheen finish with a gloss range between 5 and 20 when measured at a 60-degree meter.
3. Satin refers to low-sheen finish with a gloss range between 15 and 35 when measured at a 60-degree meter.
4. Semigloss refers to medium-sheen finish with a gloss range between 30 and 65 when measured at a 60-degree meter.
5. Full gloss refers to high-sheen finish with a gloss range more than 65 when measured at a 60-degree meter.

1.4 SUBMITTALS

A. Product Data: For each paint system specified. Include block fillers and primers.
1. Material List: Provide an inclusive list of required coating materials. Indicate each material and cross-reference specific coating, finish system, and application. Identify each material by manufacturer's catalog number and general classification.
2. Manufacturer's Information: Provide manufacturer's technical information, including label analysis and instructions for handling, storing, and applying each coating material proposed for use.
3. Certification by the manufacturer that products supplied comply with local regulations controlling use of volatile organic compounds (VOCs).

B. Samples for Initial Selection: Manufacturer's color charts showing the full range of colors available for each type of finish-coat material indicated.
1. After color selection, the Architect will furnish color chips for surfaces to be coated.

C. Samples for Verification: Of each color and material to be applied, with texture to simulate actual conditions, on representative Samples of the actual substrate.
1. Provide stepped Samples, defining each separate coat, including block fillers and primers. Use representative colors when preparing Samples for review. Resubmit until required sheen, color, and texture are achieved.
2. Provide a list of materials and applications for each coat of each sample. Label each sample for location and application.

D. Qualification Data: For firms and persons specified in the "Quality Assurance" Article to

demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

1.5 QUALITY ASSURANCE

A. Applicator Qualifications: Engage an experienced applicator who has completed painting system applications similar in material and extent to that indicated for this Project with a record of successful in-service performance.

B. Source Limitations: Obtain block fillers, primers, and undercoat materials for each coating system from the same manufacturer as the finish coats.

C. Benchmark Samples (Mockups): Provide a full-coat benchmark finish sample of each type of coating and substrate required on the Project. Comply with procedures specified in PDCA P5. Duplicate finish of approved prepared samples.
   1. The Architect will select one room or surface to represent surfaces and conditions for each type of coating and substrate to be painted.
      a. Wall Surfaces: Provide samples on at least 100 sq. ft. (9 sq. m) of wall surface.
      b. Small Areas and Items: The Architect will designate an item or area as required.
   2. After permanent lighting and other environmental services have been activated, apply coatings in this room or to each surface according to the Schedule or as specified. Provide required sheen, color, and texture on each surface.
      a. After finishes are accepted, the Architect will use the room or surface to evaluate coating systems of a similar nature.
   3. Final approval of colors will be from job-applied samples.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to the Project Site in manufacturer's original, unopened packages and containers bearing manufacturer's name and label, and the following information:
   1. Product name or title of material.
   2. Product description (generic classification or binder type).
   3. Manufacturer's stock number and date of manufacture.
   4. Contents by volume, for pigment and vehicle constituents.
   5. Thinning instructions.
   6. Application instructions.
   7. Color name and number.
   8. VOC content.

B. Store materials not in use in tightly covered containers in a well-ventilated area at a minimum ambient temperature of 45 deg F (7 deg C). Maintain containers used in storage in a clean condition, free of foreign materials and residue.
   1. Protect from freezing. Keep storage area neat and orderly. Remove oily rags and waste daily. Take necessary measures to ensure that workers and work areas are protected from fire and health hazards resulting from handling, mixing, and application.

1.7 PROJECT CONDITIONS

A. Apply water-based paints only when the temperature of surfaces to be painted and surrounding air temperatures are between 50 and 90 deg F (10 and 32 deg C).

B. Apply solvent-thinned paints only when the temperature of surfaces to be painted and surrounding air temperatures are between 45 and 95 deg F (7.2 and 35 deg C).

C. Do not apply paint in snow, rain, fog, or mist; or when the relative humidity exceeds 85 percent; or at temperatures less than 5 deg F (3 deg C) above the dew point; or to damp or wet surfaces.
1. Painting may continue during inclement weather if surfaces and areas to be painted are enclosed and heated within temperature limits specified by manufacturer during application and drying periods.

1.8 EXTRA MATERIALS

A. Furnish extra paint materials from the same production run as the materials applied in the quantities described below. Package paint materials in unopened, factory-sealed containers for storage and identify with labels describing contents. Deliver extra materials to the Owner.
1. Quantity: Furnish the Owner with an additional 5 percent, but not less than 1 gal. (3.785 L) or 1 case, as appropriate, of each material and color applied.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products listed in the paint schedules.

B. Products: Subject to compliance with requirements, provide one of the products in the paint schedules.

C. Manufacturers Names: The following manufacturers are referred to in the paint schedules by use of shortened versions of their names, which are shown in parentheses:
1. Devoe & Raynolds Co. (Devoe).
2. Fuller-O'Brien Paints (Fuller).
3. Glidden Co. (The) (Glidden).
4. Benjamin Moore & Co. (Moore).
5. PPG Industries, Inc. (PPG).
6. Pratt & Lambert, Inc. (P & L).
7. Sherwin-Williams Co. (S-W).

2.2 PAINT MATERIALS, GENERAL

A. Material Compatibility: Provide block fillers, primers, undercoats, and finish-coat materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.

B. Material Quality: Provide manufacturer's best-quality paint material of the various coating types specified. Paint-material containers not displaying manufacturer's product identification will not be acceptable.
1. Proprietary Names: Use of manufacturer's proprietary product names to designate colors or materials is not intended to imply that products named are required to be used to the exclusion of equivalent products of other manufacturers. Furnish manufacturer's material data and certificates of performance for proposed substitutions.

C. Colors: Match colors indicated by reference to manufacturer's color designations.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with the Applicator present, under which painting will be performed for compliance with paint application requirements.
   1. Do not begin to apply paint until unsatisfactory conditions have been corrected and surfaces receiving paint are thoroughly dry.
   2. Start of painting will be construed as the Applicator's acceptance of surfaces and conditions within a particular area.

B. Coordination of Work: Review other Sections in which primers are provided to ensure compatibility of the total system for various substrates. On request, furnish information on characteristics of finish materials to ensure use of compatible primers.
   1. Notify the Architect about anticipated problems using the materials specified over substrates primed by others.

3.2 PREPARATION

A. General: Remove hardware and hardware accessories, plates, machined surfaces, lighting fixtures, and similar items already installed that are not to be painted. If removal is impractical or impossible because of the size or weight of the item, provide surface-applied protection before surface preparation and painting.
   1. After completing painting operations in each space or area, reinstall items removed using workers skilled in the trades involved.

B. Cleaning: Before applying paint or other surface treatments, clean the substrates of substances that could impair the bond of the various coatings. Remove oil and grease before cleaning.
   1. Schedule cleaning and painting so dust and other contaminants from the cleaning process will not fall on wet, newly painted surfaces.

C. Surface Preparation: Clean and prepare surfaces to be painted according to manufacturer's written instructions for each particular substrate condition and as specified.
   1. Provide barrier coats over incompatible primers or remove and reprime.
   2. Cementitious Materials: Prepare concrete, concrete masonry block, cement plaster, and mineral-fiber-reinforced cement panel surfaces to be painted. Remove efflorescence, chalk, dust, dirt, grease, oils, and release agents. Roughen as required to remove glaze. If hardeners or sealers have been used to improve curing, use mechanical methods of surface preparation.
      a. Use abrasive blast-cleaning methods if recommended by paint manufacturer.
      b. Determine alkalinity and moisture content of surfaces by performing appropriate tests. If surfaces are sufficiently alkaline to cause the finish paint to blister and burn, correct this condition before application. Do not paint surfaces where moisture content exceeds that permitted in manufacturer's written instructions.
      c. Clean concrete floors to be painted with a 5 percent solution of muriatic acid or other etching cleaner. Flush the floor with clean water to remove acid, neutralize with

ammonia, rinse, allow to dry, and vacuum before painting.

3. Wood: Clean surfaces of dirt, oil, and other foreign substances with scrapers, mineral spirits, and sandpaper, as required. Sand surfaces exposed to view smooth and dust off.
   a. Scrape and clean small, dry, seasoned knots, and apply a thin coat of white shellac or other recommended knot sealer before applying primer. After priming, fill holes and imperfections in finish surfaces with putty or plastic wood filler. Sand smooth when dried.
   b. Prime, stain, or seal wood to be painted immediately on delivery. Prime edges, ends, faces, undersides, and backsides of wood, including cabinets, counters, cases, and paneling.
   c. When transparent finish is required, backprime with spar varnish.
   d. Backprime paneling on interior partitions where masonry, plaster, or other wet wall construction occurs on backside.
   e. Seal tops, bottoms, and cutouts of unprimed wood doors with a heavy coat of varnish or sealer immediately on delivery.
4. Ferrous Metals: Clean ungalvanized ferrous-metal surfaces that have not been shop coated; remove oil, grease, dirt, loose mill scale, and other foreign substances. Use solvent or mechanical cleaning methods that comply with the Steel Structures Painting Council's (SSPC) recommendations.
   a. Blast steel surfaces clean as recommended by paint system manufacturer and according to requirements of SSPC-SP 10.
   b. Treat bare and sandblasted or pickled clean metal with a metal treatment wash coat before priming.
   c. Touch up bare areas and shop-applied prime coats that have been damaged. Wire-brush, clean with solvents recommended by paint manufacturer, and touch up with the same primer as the shop coat.
5. Galvanized Surfaces: Clean galvanized surfaces with nonpetroleum-based solvents so surface is free of oil and surface contaminants. Remove pretreatment from galvanized sheet metal fabricated from coil stock by mechanical methods.

D. Materials Preparation: Mix and prepare paint materials according to manufacturer's written instructions.
   1. Maintain containers used in mixing and applying paint in a clean condition, free of foreign materials and residue.
   2. Stir material before application to produce a mixture of uniform density. Stir as required during application. Do not stir surface film into material. If necessary, remove surface film and strain material before using.
   3. Use only thinners approved by paint manufacturer and only within recommended limits.

E. Tinting: Tint each undercoat a lighter shade to simplify identification of each coat when multiple coats of the same material are applied. Tint undercoats to match the color of the finish coat, but provide sufficient differences in shade of undercoats to distinguish each separate coat.

3.3 APPLICATION

A. General: Apply paint according to manufacturer's written instructions. Use applicators and techniques best suited for substrate and type of material being applied.
   1. Paint colors, surface treatments, and finishes are indicated in the schedules.
   2. Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions detrimental to formation of a durable paint film.
   3. Provide finish coats that are compatible with primers used.

4. The term "exposed surfaces" includes areas visible when permanent or built-in fixtures, convector covers, covers for finned-tube radiation, grilles, and similar components are in place. Extend coatings in these areas, as required, to maintain the system integrity and provide desired protection.
5. Paint surfaces behind movable equipment and furniture the same as similar exposed surfaces. Before the final installation of equipment, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
6. Paint interior surfaces of ducts with a flat, nonspecular black paint where visible through registers or grilles.
7. Paint back sides of access panels and removable or hinged covers to match exposed surfaces.
8. Finish exterior doors on tops, bottoms, and side edges the same as exterior faces.
9. Finish interior of wall and base cabinets and similar field-finished casework to match exterior.
10. Sand lightly between each succeeding enamel or varnish coat.

B. Scheduling Painting: Apply first coat to surfaces that have been cleaned, pretreated, or otherwise prepared for painting as soon as practicable after preparation and before subsequent surface deterioration.
1. The number of coats and the film thickness required are the same regardless of application method. Do not apply succeeding coats until the previous coat has cured as recommended by the manufacturer. If sanding is required to produce a smooth, even surface according to manufacturer's written instructions, sand between applications.
2. Omit primer on metal surfaces that have been shop primed and touchup painted.
3. If undercoats, stains, or other conditions show through final coat of paint, apply additional coats until paint film is of uniform finish, color, and appearance. Give special attention to ensure edges, corners, crevices, welds, and exposed fasteners receive a dry film thickness equivalent to that of flat surfaces.
4. Allow sufficient time between successive coats to permit proper drying. Do not recoat surfaces until paint has dried to where it feels firm, does not deform or feel sticky under moderate thumb pressure, and where application of another coat of paint does not cause the undercoat to lift or lose adhesion.

C. Application Procedures: Apply paints and coatings by brush, roller, spray, or other applicators according to manufacturer's written instructions.
1. Brushes: Use brushes best suited for the type of material applied. Use brush of appropriate size for the surface or item being painted.
2. Rollers: Use rollers of carpet, velvet back, or high-pile sheep's wool as recommended by the manufacturer for the material and texture required.
3. Spray Equipment: Use airless spray equipment with orifice size as recommended by the manufacturer for the material and texture required.

D. Minimum Coating Thickness: Apply paint materials no thinner than manufacturer's recommended spreading rate. Provide the total dry film thickness of the entire system as recommended by the manufacturer.

E. Mechanical and Electrical Work: Painting of mechanical and electrical work is limited to items exposed in equipment rooms and in occupied spaces.

F. Mechanical items to be painted include, but are not limited to, the following:
1. Piping, pipe hangers, and supports.

2. Heat exchangers.
3. Tanks.
4. Ductwork.
5. Insulation.
6. Motors and mechanical equipment.
7. Accessory items.

G. Electrical items to be painted include, but are not limited to, the following:
1. Conduit and fittings.
2. Switchgear.
3. Panelboards.

H. Block Fillers: Apply block fillers to concrete masonry block at a rate to ensure complete coverage with pores filled.

I. Prime Coats: Before applying finish coats, apply a prime coat of material, as recommended by the manufacturer, to material that is required to be painted or finished and that has not been prime coated by others. Recoat primed and sealed surfaces where evidence of suction spots or unsealed areas in first coat appears, to ensure a finish coat with no burn through or other defects due to insufficient sealing.

J. Pigmented (Opaque) Finishes: Completely cover surfaces as necessary to provide a smooth, opaque 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.

K. Transparent (Clear) Finishes: Use multiple coats to produce a glass-smooth surface film of even luster. Provide a finish free of laps, runs, cloudiness, color irregularity, brush marks, orange peel, nail holes, or other surface imperfections.
1. Provide satin finish for final coats.

L. Completed Work: Match approved samples for color, texture, and coverage. Remove, refinish, or repaint work not complying with requirements.

3.4 FIELD QUALITY CONTROL

A. The Owner reserves the right to invoke the following test procedure at any time and as often as the Owner deems necessary during the period when paint is being applied:
1. The Owner will engage the services of an independent testing agency to sample the paint material being used. Samples of material delivered to the Project will be taken, identified, sealed, and certified in the presence of the Contractor.
2. The testing agency will perform appropriate tests for the following characteristics as required by the Owner:
a. Quantitative material analysis.
b. Abrasion resistance.
c. Apparent reflectivity.
d. Flexibility.
e. Washability.
f. Absorption.
g. Accelerated weathering.
h. Dry opacity.

i. Accelerated yellowness.
j. Recoating.
k. Skinning.
l. Color retention.
m. Alkali and mildew resistance.

3. The Owner may direct the Contractor to stop painting if test results show material being used does not comply with specified requirements. The Contractor shall remove noncomplying paint from the site, pay for testing, and repaint surfaces previously coated with the rejected paint. If necessary, the Contractor may be required to remove rejected paint from previously painted surfaces if, on repainting with specified paint, the 2 coatings are incompatible.

3.5 CLEANING

A. Cleanup: At the end of each workday, remove empty cans, rags, rubbish, and other discarded paint materials from the site.
1. After completing painting, clean glass and paint-spattered surfaces. Remove spattered paint by washing and scraping. Be careful not to scratch or damage adjacent finished surfaces.

3.6 PROTECTION

A. Protect work of other trades, whether being painted or not, against damage by painting. Correct damage by cleaning, repairing or replacing, and repainting, as approved by Architect.

B. Provide "Wet Paint" signs to protect newly painted finishes. Remove temporary protective wrappings provided by others to protect their work after completing painting operations.
1. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces. Comply with procedures specified in PDCA P1.

3.7 PAINT SHEEN SCHEDULE

A. Gloss:
1. Exterior metal surfaces.
2. Exterior hollow metal doors and frames (inside and outside surfaces).
3. Roof hatch (inside and outside surfaces).
4. Interior & exterior pipe bollards.
5. Interior & exterior metal railings.
6. Metal stair stringers and handrails.
7. Metal fixed ladders and cages.

B. Semi-gloss:
1. Interior hollow metal doors and frames.
2. Interior hollow metal window frames.
3. Wood trim or simulated wood trim scheduled to be painted.
4. Coiling metal counter doors.
5. Toilet gypsum board ceilings.
6. Interior columns surfaces to receive epoxy finish.

C. Eggshell:
1. All surfaces to be painted where a sheen is not otherwise specified.

D. Flat:
1. Exterior Insulation and Finish System.
2. Exterior gypsum board ceilings.
3. Exterior concrete.

3.8 PAINT SCHEDULE

A. Apply paint to the substrate surface scheduled as applicable as specified or as shown on the drawings in accordance with the following:

Surface	Sheen	1st Coat	DFT (mils) (per coat)	VOC (g/l)	2nd and 3rd Coats	DFT (mils) (per coat)	VOC (g/l)
EXTERIOR PAINTING SCHEDULE							
Ferrous Metal	Gloss	Pro Industrial ProCryl Universal Primer B66-310	3.0	100	2 Coats: Pro Industrial Zero VOC Enamel, B66-600 Series	4.0	0
Ferrous Metal Over factory painted surface	Gloss	Pro Industrial Zero VOC Enamel, B66-600 Series	4.0	0	1 Coat: Pro Industrial Zero VOC Enamel, B66-600 Series	4.0	0
Ferrous Metal (Existing roof mounted equip framing to remain)	Gloss	All States except CA: Epolon II Rust Inhibitive Epoxy Primer B67W400, B67A400, B67A400 State of CA: Macropoxy 646-100, B58W620, B58V620	4.0 5.0-10.0	300 <100	2 Coats: WB Acrolon 100 Water Based Urethane B65-720, B65V720	2-4	<100
Ferrous Metal (Satellite dish support and exposed rooftop refrigeration and HVAC support framing.	Gloss	Pro Industrial ProCryl Universal Primer B66-310	4.0	100	2 Coats: WB Acrolon 100 Water Based Urethane B65-720, B65V720	2-4	<100
Prefinished Ferrous Metal (Underside of metal roof panels where	Gloss	PrepRite Bonding Primer B51W50	4	42	1 Coat: Pro Industrial Zero VOC Enamel, B66-600 Series	4.0	0

Surface	Sheen	1st Coat	DFT (mils) (per coat)	VOC (g/l)	2nd and 3rd Coats	DFT (mils) (per coat)	VOC (g/l)
exposed)							
Prefinished Metal Trim (If shown to be repainted)	Low Sheen	Bond-Plex Waterbased Acrylic B71-200 Series	4.0	48	1 Coat: Bond-Plex Waterbased Acrylic B71-200 Series	4.0	48
Galvanized Trim	Semi-gloss	Pro Industrial ProCryl Universal Primer B66-310	3.0	100	2 Coats: Pro Industrial Zero VOC Enamel, B66-600 Series	4.0	0
Nonferrous and Galvanized Metal	Semi-gloss	Pro Industrial ProCryl Universal Primer B66-310	3.0	100	2 Coats: Pro Industrial Zero VOC Enamel, B66-600 Series	4.0	0
Concrete Masonry Unit Elastomeric (50 degrees F or above)	Flat	Heavy Duty Block Filler B42W46	18.0	100	2 Coats: Conflex XL High Build Elastomeric, A5-400	6-7.5	97
Concrete Masonry Unit Elastomeric (Below 50 degrees F)	Flat	Loxon Block Surfacer, A24W200 (Above 35°F)	8.0	81	2 Coats: UltraCrete Solvent Borne Masonry Coating, B46 Series (Above 20° F)	6-8	400
Exterior Insulation and Finish System	Flat	A-100 Exterior Latex Finish, A6-100 Series	1.3	49	1 Coat: A-100 Exterior Latex Finish, A6-100 Series	1.3	49
Fiber Cement Siding	Flat	Loxon Concrete and Masonry Primer, B28W8300	3.2	96	2 Coats: A-100 Exterior Latex Finish, A6-100 Series	1.3	49
Precast Concrete	Flat	Loxon Concrete and Masonry Primer, B28W8300	3.2	96	2 Coats: A-100 Exterior Latex Finish, A6-100 Series	1.3	49
Exposed Timber, Purlins, Plywood, Wood	Semi-Transparant Stain	WoodScapes Polyurethane Stain A15T5	1.3	79	1 Coat: WoodScapes Polyurethane Stain A15T5	1.3	79
Exposed Timber, Purlins, Plywood,	Opaque Stain	1 Coat: WoodScapes Latex Stain A15W51	1.3-2.6	<100	1 Coat: WoodScapes Latex Stain A15W51	1.3-2.6	<100

Surface	Sheen	1st Coat	DFT (mils) (per coat)	VOC (g/l)	2nd and 3rd Coats	DFT (mils) (per coat)	VOC (g/l)
Wood							
Gypsum Board (Ceiling)	Flat	A-100 Exterior Latex Primer, B42W43	1.4	87	2 Coats: A-100 Exterior Latex Finish, A6-100 Series	1.3	49
Concrete Pavement	Egg-shell	Setfast Acrylic Waterborne Traffic Marking Paint, TM 226/227	8.5	100	1 Coat: Setfast Acrylic Waterborne Traffic Marking Paint, TM 226/227	8.5	100
INTERIOR PAINTING SCHEDULE							
Ferrous Metal (Except as otherwise scheduled)	Gloss	Pro Industrial ProCryl Universal Primer B66-310	2	100	All States except CA: 2 Coats: Pro Mar 200 Interior Latex Gloss Enamel, B21W200 State of CA: 2 Coats: Solo Gloss Low VOC Enamel, B21WJ Series	1.5 1.6	143 49
Ferrous Metal (Except as otherwise scheduled)	Semi-gloss	ProCryl Universal Primer B66-310	2	100	2 coats ProMar 200 Zero VOC Interior Latex Semi-Gloss Enamel, B31-2600 Series	1.6	0
Ferrous Metal (Except as otherwise scheduled)	Eggshell	Pro Industrial ProCryl Universal Primer B66-310	2	100	2 Coats: ProMar 200 Zero VOC Interior Latex Eggshell Enamel, B20-2600 Series. Exception: Interior columns shall receive only 1 coat.	1.7	0
Ferrous Metal (Dryfall system over shop primed steel - overhead structure)	Flat	Waterborne Acrylic Dryfall, B42 Series Touch up prime welds, bare spots, blemishes, and scratches with Pro Industrial ProCryl Universal Primer B66-310	4.5	58			
Ferrous Metal (Dryfall system over unprimed steel - overhead structure)	Flat	Pro Industrial ProCryl Universal Primer B66-310	2	100	1 coat: Waterborne Acrylic Dryfall, B42 Series	4.5	58
Ferrous	Semi-	All states except CA:	4.0	300	1 Coat: WB Acrolon 100 Water	2-4	<10

Surface	Sheen	1st Coat	DFT (mils) (per coat)	VOC (g/l)	2nd and 3rd Coats	DFT (mils) (per coat)	VOC (g/l)
Metal (Columns and Hollow Metal Door Frames as shown on Drawings to receive epoxy)	gloss	Epolon II Rust Inhibitive Epoxy Primer B67W400, B67A400, B67A400 State of CA: Macropoxy 646-100, B58W620, B58V620	5.0-10.0	<100	Based Urethane B65-720, B65V720.		0
Galvanized Metal (Exposed Ductwork)	Flat	Pro Industrial ProCryl Universal Primer B66-310	2	100	1 coat: Waterborne Acrylic Dryfall, B42 Series	4.5	100
Galvanized Metal (freezer/cooler panels)	Eggshell	Pro Industrial ProCryl Universal Primer B66-310	2	100	2 Coats: ProMar 200 Zero VOC Interior Latex Eggshell Enamel, B20-2600 Series	1.7	0
Concrete Walls	Gloss	Loxon Concrete and Masonry Primer, B28W8300	3.2	96	All States except CA: 2 Coats: ProMar 200 Interior Latex Gloss Enamel, B21W200 State of CA: 2 Coats: Solo Gloss Low VOC Enamel, B21WJ Series	1.5 1.6	143 49
Concrete Walls	Egg-shell	Loxon Concrete and Masonry Primer, B28W8300	3.2	96	2 Coats: ProMar 200 Zero VOC Interior Latex Eggshell Enamel, B202-2600 Series	1.7	0
Concrete Masonry Unit	Gloss	PrepRite Block Filler, B25W25	8.0	45	All States except CA: 2 Coats: ProMar 200 Interior Latex Gloss Enamel, B21W200 State of CA: 2 Coats: Solo Gloss Low VOC Enamel, B21WJ Series	1.5 1.6	143 49
Concrete Masonry Unit	Eggshell	PrepRite Block Filler, B25W25	8.0	45	2 Coats: ProMar 200 Zero VOC Interior Latex Eggshell Enamel, B20-2600 Series	1.7	0
Gypsum Board	Gloss	ProMar 200 Zero VOC Latex Primer, B28W02600	1.5	0	All States except CA 2 Coats: ProMar 200 Interior Latex Gloss Enamel, B21W200 State of CA: 2 Coats: Solo Gloss Low VOC Enamel, B21WJ Series	1.5 1.6	143 49
Gypsum Board	Semi-gloss	ProMar 200 Zero VOC Latex Primer,	1.5	0	2 Coats: ProMar 200 Zero VOC Interior Latex Semi-Gloss	1.6	0

Surface	Sheen	1st Coat	DFT (mils) (per coat)	VOC (g/l)	2nd and 3rd Coats	DFT (mils) (per coat)	VOC (g/l)
		B28W02600			Enamel, B31-2600 Series		
Gypsum Board	Egg-shell	ProMar 200 Zero VOC Latex Primer, B28W02600	1.5	0	2 Coats: ProMar 200 Zero VOC Interior Latex Eggshell Enamel, B20-2600 Series	1.7	0
Wood	Semi-gloss	ProMar 200 Zero VOC Latex Primer, B28W02600	1.5	0	2 Coats: ProMar 200 Zero VOC Interior Latex Semi-Gloss Enamel, B31-2600 Series	1.6	0
Wood (Transparent sealer (Finish S1)	Stain	Wood Classics Varnish Sanding Sealer, B26V43; or approved equivalent	1.2	522	2 Coats: Wood Classics Polyurethane Varnish, A67 Series; or approved equivalent	1.7	492
Wood (Exposed laminated wood roof structure)	Semi-gloss	PrepRite ProBlock Interior/Exterior Latex Primer Sealer B51 Series	1.4	97	2 Coats: ProMar 200 Zero VOC Interior Latex Semi-Gloss Enamel, B31-2600 Series	1.6	0
Concrete Floors	Semi-gloss	Macropoxy 646-100, B58W620, B58V620	5.0-10.0	<100	Macropoxy 646-100, B58W620, B58V620	5.0-10.0	<100

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: All wall louvers shown other otherwise indicated where the type is not specified.
   1. Extruded aluminum, drainable, adjustable louvers.

1.2 REFERENCES

A. The publications listed below form a part of this specification to the extent referenced. Publications are referenced within the text by the basic designation only.

B. Air Movement and Control Association International, Inc. (AMCA):
   1. AMCA 500-L - Laboratory Methods of Testing Louvers for Ratings.

1.3 SUBMITTALS

A. Comply with the requirements of Section 01330.

B. Product Data: Submit manufactures' product data including performance data.

C. Shop Drawings: Indicate materials, construction, dimensions, accessories and installation details.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Transport, handle, store, and protect products in compliance with the requirements of Section 01600 and manufacturer's recommendations.

B. Deliver materials to site in manufacturer's original, unopened containers and packaging with labels clearly indicating manufacturer and material.

C. Store materials in a dry area, protected from damage, in accordance with manufacturer's instructions.

D. Protect materials and finishes during handling and installation.

PART 2 - PRODUCTS

2.1 DRAINABLE ADJUSTABLE LOUVERS

A. Louvers: Provide the following or approved equivalent
   1. Model No. ELF375DX by Ruskin, Kansas City, MO (816) 761-7476.

B. Fabrication:
   1. Assembly: Factory assembled louver components.
   2. Frame:
      a. Material: Extruded aluminum, Alloy 6063-T5.
      b. Wall Thickness: 0.081 inch nominal.
      c. Depth: 6 inches.
      d. Integral perimeter flange.
   3. Blades:

a. Style: drainable, horizontally mounted at 37.5 degrees.
b. Material: Extruded aluminum, Alloy 6063-T5.
c. Wall Thickness: 0.081 inch nominal.
d. Centers: 6 inches nominal.

4. Blank Off Panel: Provide when and as indicated on the Drawings.
5. Linkage: Conceal in frame.
6. Bearings: Stainless steel sleeve pressed into frame.
7. Axles: 1/2 inch plated steel hex.
8. Actuator: Electric, 120 V, 60 Hz, two-position, spring-return.
9. Insect/Bird Screen: Provide when and as shown on the drawings.
   a. Screen: Aluminum wire.
   b. Frame: Aluminum, removable, rewireable.
10. Finish: Factory applied “Kynar” finish. Color to be selected by Architect from a full range of manufacturer’s standard colors.

C. Performance Data:
1. Based on testing a 48 inch by 48 inch size unit in accordance with AMCA 500-L.
2. Free Area: 50 to 55 percent.
3. Static Pressure Loss: Not to exceed 0.12 inch water gauge at an airflow rate of 846 fpm free area intake velocity.
4. Water Penetration: Not to exceed 0.01 oz. per sq. ft. of free air area at a flow rate of 846 fpm free area velocity.

D. Design Load: Provide louvers capable of withstanding the effects of gravity loads and wind loads, as indicated on the Structural Drawings or a minimum windload of 20 psf, acting inward or outward, without permanent deformation of louver components, noise or metal fatigue caused by louver blade rattle or flutter, or permanent damage to fasteners and anchors.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Inspect areas to receive louvers. Do not proceed, if unsatisfactory conditions exist that will not allow for a complete and proper installation. Proceed upon correction.

3.2 INSTALLATION

A. Install in accordance with manufacturer’s instructions. Provide appurtenances required for a complete and proper installation.

B. Install plumb, level, flush, and in alignment with adjacent work.

3.3 CLEANING

A. Remove temporary coverings and protection of adjacent work areas.

B. Clean exposed surfaces that are not protected by temporary covering, to remove fingerprints and soil during construction period. Do not let soil accumulate until final cleaning.

C. Before final inspection, clean exposed surfaces with water and a mild soap or detergent not harmful to finishes. Thoroughly rinse surfaces and dry.

D. Restore items damaged during installation and construction so no evidence remains of corrective work. If results of restoration are unsuccessful as determined by Architect, remove dam-

aged units and replace with new units. Touch up minor abrasions in finishes with air-dried coating that matches color and gloss of, and is compatible with, factory-applied finish coating.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Aluminum flagpoles.
   2. Flags.

1.2 REFERENCES

A. The publications listed below form a part of this specification to the extent referenced. Publications are referenced within the text by the basic designation only.

B. The Aluminum Association, Inc. (AA):
   1. AA DAF45 – Designation System for Aluminum Finishes

C. ASTM International (ASTM):
   1. ASTM B 221 - Aluminum And Aluminum-Alloy Extruded Bars, Rods, Wire, Profile, And Tubes
   2. ASTM B 917 - Standard Practice For Heat Treatment Of Aluminum-Alloy Castings From All Processes.

D. National Association of Architectural Metal Manufacturing (NAAMM):
   1. NAAMM 1001 – Guide Specifications for Design of Metal Flagpoles Manual.

1.3 DELIVERY, STORAGE AND HANDLING

A. Transport, handle, store, and protect products in compliance with the requirements of Sections 1600 and manufacturer’s recommendations.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following or approved equal:
   1. American Flagpole; A Kearney-National Inc. Company. Abingdon VA (800) 368-7171.
   2. Concord Industries, Inc., Dallas, TX (800) 527-3902.
   3. Eder Flagpole Company, Oak Creek, WI (800) 558-6044.

2.2 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide flagpoles capable of withstanding the effects of wind loads, determined according to NAAMM FP 1001, "Guide Specifications for Design of Metal Flagpoles."
   1. Flag Size: Design flagpole based upon 4 foot x 6 foot nylon flag.
   2. Basic Wind Speed: Design flagpole based on 90 mph wind speed.

2.3 FLAGPOLES

A. Groundset Flagpoles: Provide cone tapered ground set flagpole fabricated from extruded aluminum tubing complying with ASTM B 221, Alloy 6063, with a minimum wall thickness of 5/32 inch. Heat treat after fabrication to comply with ASTM B 597, Temper T6.

1. Length: 30’-0” exposed. Overall length shall be as shown to include unexposed portion below ground.
2. Mounting: Ground sleeve type.

2.4 FITTINGS AND ACCESSORIES

A. Finial Ball: Manufacturer's standard flush-seam ball, sized as indicated to match flagpole-butt diameter.
   1. Finish: Gold Anodized.

B. External Halyard: Ball-bearing, non-fouling rotating or stationary truck assembly of cast metal with continuous 5/16-inch-diameter, braided nylon halyard, ground hoisted.

C. Cleats: Cast aluminum 9 inch min. with fasteners.
   1. Finish exposed metal surfaces to match flagpole.

D. Halyard Flag Snaps: Provide two swivel snap hooks per halyard.

E. Cleat Box: Aluminum box with cylinder lock. Provide 2 keys.

F. Mounting Hardware:
   1. Provide ground sleeve assembly including sleeve, centering wedges, collar, ground rod, and other required accessories.

2.5 FINISHES

A. Natural Satin Finish: Provide fine, directional, medium satin polish (AA-M32); buff complying with AA-M20; and seal aluminum surfaces with clear, hard-coat wax.

2.6 FLAGS

A. Provide 6 ft. by 10 ft. nylon American flag with sewn stripes and embroidered stars.

B. Provide 6 ft. by 10 ft. nylon State Of Georgia flag with sewing and embroidering as indicated by Owner.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas where flagpoles will be installed. Do not proceed with Work until unsatisfactory conditions have been corrected.

B. Beginning of installation indicates acceptance of existing conditions.

3.2 INSTALLATION

A. Install flagpoles where and as shown and according to manufacturer's written instructions.

B. Install halyard and snaps leaving installation ready for use.

C. Install cleat inside lockable cleat box as shown on drawings.

3.3 FIELD QUALITY CONTROL

A. Inspect flagpole installation, accessory attachment, and vertical alignment.

B. Correct deficiencies in Work which inspection indicates are not in compliance with contract documents.

3.4 ADJUSTING AND CLEANING

A. Clean flagpole surfaces immediately prior to installation.

B. Adjust operating devices for smooth halyard and flag function.

END OF SECTION

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 types of signs:
1. Interior panel signs.
2. Vinyl letting at storefront
3. Exterior Wall Mounted Signs
4. Exterior Digital Display Signs

B. Related Sections: The following Sections contain requirements that relate to this Section:
1. Division 1 Section "Temporary Facilities" for temporary project identification signs.
2. "Electrical Identification" for labels, tags, and nameplates for electrical equipment.
3. "Interior Lighting" for illuminated exit signs.
4. Electrical service and connections for illuminated letters.

1.3 SUBMITTALS

A. General: Submit the following according to the Conditions of the Contract and Division 1 Specification Sections.

B. Product data:
1. Manufacturer's signed statement regarding compliance with QUALITY ASSURANCE Article.

2. Manufacturer's product literature indicating units and designs selected.

3. Evidence of manufacturer's computerized data retrieval program for tracking of Project for sign typography, message strip requirements and other pertinent data from schedule input to final computerized typography on finished product.

4. Maintenance data and cleaning requirements for exterior surfaces.

5. Attachment techniques for specific substrates.

C. Shop drawings:
1. Indicate materials, sizes, configurations, and applicable substrate mountings (for interior and exterior signs as necessary for application).

2. Artwork for special ** graphics. ** headers. **

3. Signage schedule complete with location of each sign and required copy; include floor plans.

D. Samples: Samples will ***not*** be returned for use in Project.

1. Typography sample for message strips and headers copy.

2. Interior Signs: Full size samples for holder, insert, and copy in colors specified. Provide

sample in small size sign.

3. Exterior signs: Provide full size samples of colors and materials of specific project requirements.

E. Closeout Submittals:
1. Furnish appropriate checklist for aiding in reordering after Date of Substantial Completion. Maintain computer schedule program for ** five ** years for ordering new signage required by Owner.

2. Furnish one complete SignWord software package Windows 7 or later, in Owner selected format for PC type computer.

3. Furnish SignWord Color paper system

1.4 QUALITY ASSURANCE

A. Manufacturer:
1. Work required under this section from manufacturers regularly engaged in work of this magnitude and scope for minimum of five years.
2. Maintain computer link between schedule input and computerized typography production.

B. Single-Source Responsibility:
1. For each separate sign type required, obtain signs from one source of a single manufacturer.

C. Design Concept: The Drawings indicate sizes, profiles, and dimensional requirements of signs and are based on the specific types and models indicated.

1.5 PROJECT CONDITIONS

A. Field Measurements: Take field measurements prior to preparation of shop drawings and fabrication to ensure proper fitting. Show recorded measurements on final shop drawings. Coordinate fabrication schedule with construction progress to avoid delay.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Manufacturers of interior signs;
a. APCO Graphics, Inc. “Elements” Industrial System (Basis of Design); 388 Grant Street SE, Atlanta, Georgia, 30312, USA. Phone; (404) 688-9000. Fax; (404) 577-3847.
b. Option Signs Inc, 165 Tidwell Drive, Suite A, Alpharetta, Georgia, 30004, Phone; (770) 569-5871. Fax; (770) 569-5456.

c. Other manufacturer's products are acceptable if submitted in accord with Product Options and Substitutions section and are in strict compliance with these specified requirements.

2. Manufacturers of exterior wall mounted signs:
a. Signarama, 225-B Laredo Drive, Decatur, GA 30030. Phone: 404-298-5988.

b. A-Brite Signs, 534 Main Street, Forest Park, GA 30297. Phone 404-963-6462.
c. Apex Signs & Graphics, 600 N. Main Street, Alpharetta GA 30009. Phone: 678-795-0775.
d. FASTSIGNS, 131 E Trinity Pl, Decatur, GA 30030. Phone: (470-440-2315
e. Other manufacturer's products are acceptable if submitted in accord with Product Options and Substitutions section and are in strict compliance with these specified requirements

3. Manufacturers of exterior digital display signs:
a. FAST SIGNS of Atlanta
b. Signs by Tomorrow, 2030 Powers Ferry Road, Suite 340, Atlanta GA 30339. email: info@sbtatlantanorth.com Phone 678-398-7905
c. Clayton Signs, 5198 North Lake Dr. Lake City, GA 30260. Phone 404-361-3800; Fax: 404-361-7038; email: sales@claytonsigns.com
c. Other manufacturer's products are acceptable if submitted in accord with Product Options and Substitutions section and are in strict compliance with these specified requirements.

2.2 INTERIOR SIGNAGE

A. Standard Assembly
1. Combination of extruded aluminum components, composite aluminum sheet and injection molded components, creating modular signs with a special, concealed pin lock device to secure a clear cover and/or sign insert material into the frame. Possible sign insert/display combinations include:
a. Non-Glare Acrylic Lens with Subsurface Paper Insert / Digital Output Display
b. ADA (Tactile/Braille) Plaques
c. ADA Bands (always at the bottom of the sign)
d. Decorative Metal and/or Wood* Components (always at the bottom of the sign)
e. Painted Plaques with Silkscreen Printed Graphics

B. Assembly allows for flexibility of size and configuration, providing a modular, vandal-resistant solution for signs ranging from single-insert identification signs to large directories and directional signs.

1. Surface Mounted Signs (Wall or Office Panel):
a. Attachment to wall surfaces via double-sided vinyl tape or concealed mechanical fasteners.
b. Attachment to office panels via concealed stainless steel pins or special aluminum or plastic clips.

2. Wall Projection Signs: Combination of two signs attached back-to-back utilizing a modular, extruded aluminum "T" bracket (APCO's CMT-M component).

3. Ceiling Mounted Signs: Combination of two signs attached back-to-back utilizing an extruded aluminum "T" bracket (APCO's CMT-M component). For such configurations, the aluminum edge profiles, offered in four different shapes, will be at the top and bottom of the assembly.

C. Inner-Access Assembly
1. Combination of extruded aluminum components, composite aluminum sheet, non-glare acrylic, and injection molded components, creating modular signs to house subsurface paper inserts / digital output displays. Special decorative elements and/or ADA compliant bands may be applied at any position on the surface of the non-glare acrylic, from top to bottom. Subsurface displays are removed by inserting a "Post-It" note, or similar, behind

the top portion of the non-glare acrylic, applying pressure and then pulling upward.

D. Dimensional Lettering:
1. APCO-MG-F Series; Metal Graphics – Fabricated. Fabricated metal graphics are ideally suited for bold, deep letter forms
a. Material Options: Aluminum, Brass, Bronze, Copper, Stainless Steel & Painted Metal
b. Sizes Range: 3" Up
c. Thickness Range: 3/8" to 24"
d. Finishes: Satin #4 & #6, Mirror #8, Chrome Plate, Oxidized, Patinas, Polyurethanes
e. Anodized Clear & Color, Custom Metals, Textures and Patterns.

2. 1'-0" high lettering shall read "**DEKALB COUNTY FIRE STATION #7"** Location TBD by Architect

E. Finishes: Colors and Surface Textures: For exposed sign material that requires selection of materials with integral or applied colors, surface textures or other characteristics related to appearance, provide color matches indicated, or if not indicated, as selected by the Architect from the manufacturer's standards.

2.3 VINYL LETTERING AT STOREFRONT

A. 6" High white lettering PSV Graphics (pressure sensitive vinyl) include typestyles, arrows and symbols cut with computerized precision from sheet vinyl applies to storefront glass.

B. Lettering to read "**DeKalb County Fire Station #7" w/ DeKalb Co Logo**.

2.5 EXTERIOR WALL MOUNTED SIGNS

A. Signs types complying with requirements specified on Drawings. Wall mounted signs include signs attached to exterior of building walls and monument.

B. Channel Letters:
1. Non-illuminated plastic channel letters, with anchors to substrate per manufacturers recommendations.

2. Sizes as indicated on drawings.

3. Color to be selected by Architect or Owner's Representative from manufacturer's standard colors.

C. Aluminum Letters:
1. Sizes as indicated on drawings.

2. Attachments: Provide as recommended by manufacturer for attachment to specific substrate.

3. Color to be selected by Architect or Owner's Representative from manufacturer's standard colors.

2.6 EXTERIOR DIGITAL DISPLAY SIGNS

A. Sign types complying with basis of design requirements and the following (provide when and where indicated on drawings).

B. Basis of design Galaxy eCCB Displays
   1. Red/Amber LED sign.

   2. Two views (2V)

   3. Size: 30”x60”

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install signage holders in locations with mounting types indicated in accord with reviewed shop drawings. Square, plumb, and level units.

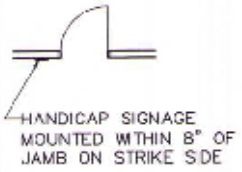
B. Install inserts not more than 48 hours prior to Date of Substantial Completion complete with correct copy in place. Conform to ADA requirements for tactile graphics signage.

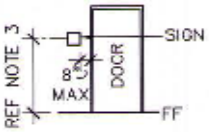
3.2 CLEANING AND PROTECTION

A. After installation, clean soiled sign surfaces according to the manufacturer's instructions. Protect units from damage until acceptance by the Owner.

The next pages contain general signage standards. Coordinate with Integrated Sign Systems and Owner for final layout of each panel sign to be prepared.

SIGNAGE LEGEND





1. REQUIRED ACCESSIBLE ELEMENTS SHALL BE IDENTIFIED BY THE INTERNATIONAL SYMBOL OF ACCESSIBILITY AT THE FOLLOWING LOCATIONS

   -ACCESSIBLE ENTRANCES WHERE NOT ALL ENTRANCES ARE ACCESSIBLE

   -ACCESSIBLE ROOMS WHERE MULTIPLE SINGLE-USER TOILETS ARE CLUSTERED AT A SINGLE LOCATION

   -UNISEX TOILET AND RESTROOMS

   -ACCESSIBLE DRESSING ROOMS WHERE NOT ALL SUCH ROOMS ARE ACCESSIBLE

2. DIRECTIONAL SIGNAGE INDICATING THE ROUTE TO THE NEAREST LIKE ACCESSIBLE ELEMENT SHALL BE PROVIDED AT THE FOLLOWING LOCATIONS. THESE DIRECTIONAL SIGNS SHALL INCLUDE THE INTERNATIONAL SYMBOL OF ACCESSIBILITY

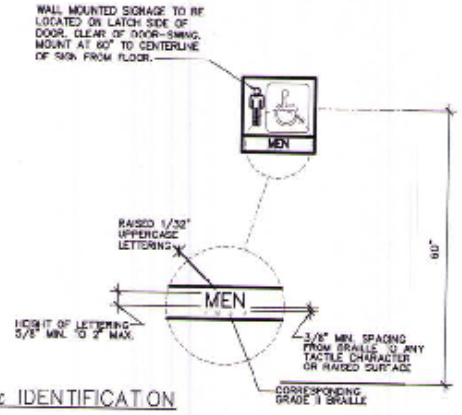
   -AT EACH SEPARATE-SEX TOILET INDICATING THE LOCATION OF THE NEAREST UNISEX TOILET

3. TACTILE SIGNAGE SHALL BE LOCATED ON THE WALL TO THE DOOR'S LATCH SIDE AT A HEIGHT OF 60" AFF MAX TO THE BASELINE OF THE HIGHEST TACTILE CHARACTER. SIGNS MAY BE PLACED ON THE NEAREST ADJACENT WALL WHEN THERE IS NO WALL SPACE ON THE LATCH SIDE

4. CHARACTER AND SYMBOLS OF SIGNS SHALL BE IN CONTRAST WITH THEIR BACKGROUND AND SHALL BE EGGSHELL, MATTE, OR OTHER NON-GLARE MATERIALS OR FINISHES

5. ACCESSIBLE SIGNAGE SHALL USE GRADE II BRAILLE AND MUST COMPLY WITH ANSI A117.1 SECTION 703.4

RESTROOM SYMBOLS



SIGNS & IDENTIFICATION

1. THE INTERNATIONAL SYMBOL OF ACCESSIBILITY SHALL BE THE STANDARD USED TO IDENTIFY FACILITIES THAT ARE ACCESSIBLE TO AND USABLE BY PHYSICALLY DISABLED PERSONS AS SET FORTH IN TITLE 24 AND AS SPECIFICALLY REQUIRED IN THIS SECTION

2. THE INTERNATIONAL SYMBOL OF ACCESSIBILITY SHALL CONSIST OF A WHITE FIGURE ON A BLUE BACKGROUND. THE BLUE SHALL BE EQUAL TO COLOR NO. 15090 IN FEDERAL STANDARD 595B

3. LETTERS AND NUMBERS ON SIGNS SHALL HAVE A WIDTH-TO-HEIGHT RATIO OF BETWEEN 3:5 AND 1:1 AND A STROKE WIDTH-TO-HEIGHT RATIO BETWEEN 1:5 AND 1:10

4. CHARACTERS AND NUMBERS ON SIGNS SHALL BE SIZED ACCORDING TO THE VIEWING DISTANCE FROM WHICH THEY ARE TO BE READ. THE MINIMUM HEIGHT IS MEASURED USING AN UPPER CASE CHARACTER. LOWER CASE CHARACTERS ARE PERMITTED. FOR SIGNS SUSPENDED OR PROJECTED ABOVE THE FINISH FLOOR IN COMPLIANCE, THE MINIMUM CHARACTER HEIGHT SHALL BE 3"

5. CHARACTERS AND SYMBOLS SHALL CONTRAST WITH THEIR BACKGROUND

6. WHEN RAISED CHARACTERS OR SYMBOLS ARE USED, THEY SHALL CONFORM TO THE FOLLOWING:

   A. LETTERS AND NUMBERS ON SIGNS SHALL BE RAISED 1/32" MINIMUM AND SHALL BE SANS-SERIF UPPERCASE CHARACTERS ACCOMPANIED BY GRADE 2 BRAILLE

   B. RAISED CHARACTERS OR SYMBOLS SHALL BE A MINIMUM OF 5/8" HIGH

   C. PICTORIAL SYMBOL SIGNS (PICTOGRAMS) SHALL BE ACCOMPANIED BY THE EQUIVALENT VERBAL DESCRIPTION PLACED DIRECTLY BELOW THE PICTOGRAM. THE BORDER DIMENSION OF THE PICTOGRAM SHALL BE A MINIMUM OF 6" IN HEIGHT

7. CONTRACTED GRADE 2 BRAILLE SHALL BE USED WHEREVER BRAILLE SYMBOLS ARE SPECIFICALLY REQUIRED IN OTHER PORTIONS OF THESE REGULATIONS. DOTS SHALL BE 1/10" ON CENTER IN EACH CELL WITH 2/10" SPACE BETWEEN CELLS. DOTS SHALL BE RAISED A MINIMUM OF 1/40" ABOVE THE BACKGROUND

8. WHEN PERMANENT IDENTIFICATION IS PROVIDED FOR ROOMS AND SPACES, RAISED LETTERS SHALL BE ACCOMPANIED BY BRAILLE. SIGNS SHALL BE INSTALLED ON THE WALL ADJACENT TO THE LATCH SIDE OF THE DOOR. WHERE THERE IS NO WALL SPACE ON THE LATCH SIDE, INCLUDING DOUBLE LEAF DOORS, SIGNS SHALL BE PLACED ON THE NEAREST ADJACENT WALL, PREFERABLY ON THE RIGHT. MOUNTING HEIGHT SHALL BE 60" ABOVE THE FINISHED FLOOR TO THE CENTERLINE OF THE SIGN. MOUNTING LOCATION SHALL BE DETERMINED SO THAT A PERSON MAY APPROACH WITHIN 3" OF THE SIGNAGE WITHOUT ENCOUNTERING PROTRUDING OBJECTS OR STANDING WITHIN THE SWING OF A DOOR

END OF SECTION

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Special Conditions apply to this Section.

1.2 SUMMARY

A. This section includes, but is not limited to:

1. Fire extinguishers.
2. Fire extinguisher cabinets.
3. Accessories.

1.3 RELATED SECTIONS

A. Section 06100 - Rough Carpentry: Wood blocking product and execution requirements.

1.4 REFERENCES

A. NFPA 10 - Standard for Portable Fire Extinguishers; National Fire Protection Association; 2007.

B. UL (FPED) - Fire Protection Equipment Directory; Underwriters Laboratories Inc.; current edition.

1.5 SUBMITTALS

A. Shop Drawings: Indicate cabinet physical dimensions.

B. Product Data: Provide extinguisher operational features.

C. Manufacturer's Installation Instructions: Indicate special criteria and wall opening coordination requirements.

D. Maintenance Data: Include test, refill or recharge schedules and re-certification requirements.

1.6 ENVIRONMENTAL REQUIREMENTS

A. Do not install extinguishers when ambient temperature may cause freezing of extinguisher ingredients.

1.7 WARRANTY

A. Provide warranty per applicable building codes. In no way shall minimum warranty period be less than one year.

1.8 REGULATORY REQUIREMENT

A. Quantity and locations of extinguishers shall be coordinated with AHJ prior to purchase and installation. Provide all fire extinguishers at locations approved by local Fire Marshal.

PART 2 PRODUCTS

2.1 FIRE EXTINGUISHERS

A. Fire Extinguishers - General: Comply with product requirements of NFPA 10 and applicable codes, whichever is more stringent.

1. Provide extinguishers labeled by Underwriters Laboratories Inc. for the purpose specified and indicated.

B. Dry Chemical Type Fire Extinguishers: Stainless steel tank, with pressure gage.

1. Provide K class at Kitchen. Provide Class B:C at all other locations.

2. Size 10.

3. Finish: Baked enamel, red color.

2.2 FIRE EXTINGUISHER CABINETS

A. Metal: Formed primed steel sheet; 0.036 inch (0.9 mm) thick base metal.

B. Cabinet Configuration: Semi-recessed type.

1. Sized to accommodate accessories.

2. Exterior and interior nominal dimensions as required to accommodate fire extinguisher.

3. Trim: Returned to wall surface, with 2-1/2 inch (64 mm) projection, 1-3/4 inch (44 mm) wide face.

4. Form cabinet enclosure with right angle inside corners and seams. Form perimeter trim and door stiles.

C. Door: 0.036 inch (0.9 mm) thick, reinforced for flatness and rigidity; latch. Hinge doors for 180 degree opening with two butt hinge. Provide nylon catch.

D. Door Glazing: Glass, clear, 1/8 inch (3 mm) thick float. Set in resilient channel gasket glazing.

E. Cabinet Mounting Hardware: Appropriate to cabinet. Pre-drill for anchors.

F. Weld, fill, and grind components smooth.

G. Finish of Cabinet Exterior Trim and Door: Red enamel.

H. Finish of Cabinet Interior: White enamel.

2.3 ACCESSORIES

A. Extinguisher Brackets: Formed steel, chrome-plated.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify rough openings for cabinet are correctly sized and located.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install cabinets plumb and level in wall openings, mounting height from finished floor to inside bottom of cabinet, as indicated on drawings or required by governing authority.

C. Secure rigidly in place.

D. Place extinguishers and accessories in cabinets.

END OF SECTION

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. Owner furnished, Contractor installed Gear Lockers
2. Owner furnished, Contractor installed Personal Lockers
3. Owner furnished, Contractor installed Storage Lockers

1.3 SUBMITTALS

A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.

B. Product Data: Manufacturer's printed data including materials, accessories, construction, finishes, assembly, and installation instructions for lockers and benches.

C. Shop Drawings: Layout and dimensions of metal lockers and benches. Indicate relationship to adjoining surfaces. Show locker elevations and details, fillers, trim, base, sloping tops, and accessories. Include locker numbering sequence. Indicate installation and anchorage requirements.

D. Samples for Initial Color Selection: Manufacturer's color charts showing a full range of available colors.

E. Samples for Color Verification: Samples showing actual colors prepared on same material to be used for the Work.

F. Maintenance Instructions: Instructions for cleaning lockers and for adjusting, repairing, and replacing locker doors and latching mechanisms.

1.4 QUALITY ASSURANCE

A. Single-Source Responsibility: Obtain locker units and accessories from one manufacturer.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver lockers until spaces to receive them are clean, dry, and ready for locker installation.

B. Receive Owner Furnished products in compliance with the requirements of Section 01640.

C. Protect lockers from damage during delivery, handling, storage, and installation.

D. Deliver master keys, control keys, and combination control charts to Owner.

E. Acceptance at Site: inspect products upon delivery of products to Site to verify quantity of products furnished and shall report discrepancies in quantity delivered or obvious damage to products delivered to the site.

PART 2 - PRODUCTS

2.1 GEAR LOCKERS (OWNER FURNISHED CONTRACTOR INSTALLED)

A. Manufacturer / Supplier of Gear Lockers unless otherwise specified: GearGrid Corporation

B. Description: Wall Mounted Gear lockers
1. Unassembled, with Mounting Brackets
2. Frame: Heavy Duty 1 1/4” Steel Tubing
3. Side and Back: High Strength 1/4” wire, 3”x3” square grid
4. Dimensions: 24”Wx20”Dx72”H
5. Color: Red
6. Finish: Powder Coated

C. Accessories:
1. Number Plate.
2. Shelves/Hooks: Two (2) adjustable 1/4" wire shelves, Three (3) apparel hooks

2.2 PERSONAL LOCKERS (OWNER FURNISHED CONTRACTOR INSTALLED)

A. Manufacturer / Supplier of Personal Storage Lockers unless otherwise specified: KI Spacesaver Corporation

B. Description: FreeStyle
1. Unassembled
2. Construction: 18ga steel double-wall, welded with reinforced corners
3. Configuration: Single door with 18” high bench drawer.
4. Lock option: hasp for pad lock
5. Dimensions: 24”Wx24”Dx72”H
6. Color: To be selected from manufacturers standard colors options
7. Finish: Powder Coated
8. Door Type: Plain perforated
9. Accessories: To be selected by Owner

2.3 STORAGE LOCKERS (OWNER FURNISHED CONTRACTOR INSTALLED)

A. Manufacturer / Supplier of Storage Lockers unless otherwise specified: Global Industries

B. Description: Five Tier Metal Lockers
1. Unassembled.
2. Configuration: Five tier, 24 ga body.

3. Dimensions: 12”Wx12”Lx 12”x66”H
4. Material: Steel
5. Color: To be selected
6. Finish: To be selected
7. Lock: padlock latch and hasp closure
8. Legs: 6” high
9. Doors: 18 ga Louvered

PART 3 - EXECUTION

3.1 EXAMINATION

A. Install metal lockers complete with accessories according to manufacturer's recommendations. Install plumb, level, rigid, and flush.

B. Assemble knock-down lockers with standard fasteners according to manufacturer's recommendations with no exposed fasteners on door faces and face frames.

C. Connect together welded locker groups with standard fasteners according to manufacturer's recommendations, with no exposed fasteners on face frames.

D. Anchor lockers to floors and walls at intervals recommended by manufacturer but no greater than 36 inches (910 mm). Install anchors through back-up reinforcing plates where necessary to avoid metal distortion, using concealed fasteners.

E. Install recess trim to recessed lockers using concealed fasteners. Provide hairline joints and concealed splice plates.

F. Install sloping top units to lockers using concealed fasteners. Provide hairline joints and concealed splice plates.

G. Install boxed end panels to conceal exposed ends of nonrecessed lockers.

H. Install finished end panels to conceal exposed ends of nonrecessed lockers.

3.2 INSTALLATION

A. Install metal lockers complete with accessories according to manufacturer's recommendations. Install plumb, level, rigid, and flush.

B. Assemble knock-down lockers with standard fasteners according to manufacturer's recommendations with no exposed fasteners on door faces and face frames.

C. Connect together welded locker groups with standard fasteners according to manufacturer's recommendations, with no exposed fasteners on face frames.

D. Anchor lockers to floors and walls at intervals recommended by manufacturer but no greater than 36 inches (910 mm). Install anchors through back-up reinforcing plates where necessary to avoid metal distortion, using concealed fasteners.

E. Install recess trim to recessed lockers using concealed fasteners. Provide hairline joints

and concealed splice plates.

F. Install sloping top units to lockers using concealed fasteners. Provide hairline joints and concealed splice plates.

G. Install boxed end panels to conceal exposed ends of nonrecessed lockers.

H. Install finished end panels to conceal exposed ends of nonrecessed lockers.

3.3 ADJUSTING, CLEANING, AND PROTECTION

A. Adjust doors and latches to operate easily without binding. Verify that integral locking devices are operating properly.

B. Clean interior and exposed exterior surfaces and polish stainless-steel and nonferrous metal surfaces.

C. Protect lockers from damage, abuse, dust, dirt, stain, or paint. Do not permit locker use during construction.

D. Touch up marred finishes, or replace locker units that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by locker manufacturer.

END OF SECTION

GENERAL

SUMMARY

A. Section Includes:

1. Fixed blade extruded-aluminum exterior mounted louvered sunshades including attachment brackets and trim.

PERFORMANCE REQUIREMENTS

B. Design: Design sunshades, including comprehensive engineering analysis by a qualified engineer, using structural performance requirements and design criteria indicated.

C. Structural Performance: Sunshades shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated without permanent deformation of sunshade components and mounting brackets, or permanent damage to fasteners and anchors.

1. Wind Loads: Determine loads based on a uniform pressure of 30 lb./sq. ft. (1435 Pa), acting perpendicular to sunshade surfaces.

D. Thermal Movements: Provide sun control system that allows for thermal movements resulting from a maximum change in ambient and surface temperature as indicated without buckling, overstressing of components, failure of connections, or other detrimental effects.

1. Temperature Range: 120° F (49° C) ambient and 180° F (82° C) at material surfaces.

SUBMITTALS

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

1. Include technical data demonstrating mounting and fastening methods, material descriptions, construction details, dimensions of assemblies and components, appearance details, and finishes.

F. Shop Drawings: For exterior sunshades and accessories. Include plans, elevations, sections, details, and attachments to other work. Show frame profiles and blade profiles, angles, and spacing.

G. Samples: For each type of metal finish required.

H. Submittal: For sunshades indicated to comply with structural performance requirements and design criteria.

PRODUCTS

MATERIALS

I. Aluminum Extrusions: ASTM B 221M, Alloy 6063-T5.

J. Aluminum Sheet: ASTM B 209M, Alloy 3003 with temper as required for forming.

K. Fasteners: Use types and sizes to suit unit installation conditions.

1. For fastening aluminum, use aluminum or stainless-steel fasteners.

FABRICATION, GENERAL

L. Fabricate frames, including outriggers, in dimensions as indicated. Include allowances for fabrication and installation tolerances, adjoining material tolerances, and thermal movements.

M. Space the blades as indicated, and the outermost blades within the frame, to create a uniform appearance.

N. Join frame members to each other and to fixed louver blades with threaded fasteners concealed from view.

FIXED, EXTRUDED-ALUMINUM EXTERIOR SUNSHADES

O. Airfoil Profile Blade Louvered Sun Control System

1. Basis-of-Design Product: Architectural Louvers Co. (Harray, LLC); Model H6A. Subject to compliance with requirements, provide the specified product or comparable product by one of the following:

a. Manufacturers of equivalent products submitted and approved in accordance with Section 01 25 00 - Product Substitution Procedures.

2. Frame Depth: 6 inches (152 mm)

3. Trim Profile: Rectangular tube
4. Blade Profile: 6” Airfoil shape
5. Blade Angle: 35°
6. Blade Spacing: 8 inches (203 mm) on center
7. Outrigger Thickness: Not less than 0.125 inch (2.54 mm) for structural shapes, not less than 0.25 inch (6.35 mm) for flat materials.
8. Frame and Blade Nominal Thickness: Not less than 0.080 inch (2.03 mm).

ALUMINUM FINISHES

P. High-Performance Organic Finish: 3-coat fluoropolymer finish complying with AAMA 2605 and containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pre-treat, and

apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

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

EXECUTION

INSTALLATION

Q. Locate and mount sunshades level, plumb, and at indicated alignment with adjacent work.

R. Use fastening and mounting methods in accordance with manufacturer instructions.

S. Use concealed anchorages where possible, with locations as directed by manufacturer instructions.

T. Repair damaged finishes so no evidence remains of corrective work. Return items that cannot be refinished in the field to the factory and refinish entire unit or provide new units.

U. Protect galvanized and unfinished nonferrous-metal surfaces that will be in contact with concrete, masonry, or dissimilar metals from corrosion and galvanic action by applying a heavy coating of bituminous paint.

END OF SECTION

PART 1 GENERAL

1.1 SUMMARY

A. This section includes:
   1. Tower Clock Components
   2. Remote Control System

B. Related Sections
   1. Division 26 – Electrical: All raceways, junction boxes, and conduit wire required for a complete operational clock system

1.2 PERFORMANCE REQUIREMENTS

Structural Performance: Design, fabricate and install exterior clocks to withstand loads from gravity, wind, seismic and structural movement, including thermally induced movement, according to ASCE/SEI 7 and to resist without failure, other conditions of in-service use, including exposure to weather.

1.3 SUBMITTALS

A. Product Data
   1. Provide manufacturer's data sheets for all clock equipment and related devices
   2. Include material descriptions, hardware, fittings and mounting accessories

B. Shop Drawings
   1. Show materials, fabrication, full dimensions on clock components, face/hand/digit, case, mounting heights, blocking requirements, finish details, clearances and installation details
   2. Provide coordination with electrical to include:
      a) Wiring diagrams
      b) Location of master clock controller (IT Room)
      c) Responsibility of electrical contractor
      d) Responsibility of clock installer

C. Operation & Maintenance Data
   1. Provide instruction manual for master clock controller
   2. Provide complete Operation and Maintenance manuals as per

close-out requirements

D. Samples, if requested
1. Translucent dial material, 6” square
2. Dial digit, full size, in required finish
3. Metal for dial overlay, if applicable, in required finish, 6” digit
4. Hand, 12” minimum, in required finish and fabrication
5. Color chip samples of finishes

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: company specializing in manufacturing products specified in this section with no less than 10 years of documented experience

B. Installer Qualifications: Company specializing in performing the work of this section and approved by clock manufacturer

1.5 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of walls and other construction contiguous with exterior clocks by field measurements before fabrication and indicate on shop drawings

B. Environmental Limitations: Do not deliver or install exterior clocks until wet work on facades and inside tower is complete and dry

C. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit installation of exterior clocks to be performed w/o damage to components or hazardous to installer

1.6 WARRANTY

A. Manufacturer’s standard warranty for repair or replacement of components which fail in materials or workmanship within specified warranty period to include structural failures, faulty hardware operation, and deterioration of metals, finishes, and other materials beyond normal weathering

B. Provide standard three-year warranty for clock and controller

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Lumichron, Inc. http://www.Lumichron.com

B. Americlock, Inc. http://www.Americlock.com

C. Electric Time Company, Inc. http://www.ElectricTime.com

2.2 EXTERIOR CLOCKS

A. Furnish complete clock system consisting of 1 fully enclosed case clock, and 1 remote fully automatic control system

B. Tower Clock Components

1. Clock Case:
    a) As selected by Architect, fabricated all-aluminum, .063" min thickness, fully-enclosed case, nominal size 4' diameter, built with an additional 1-1/2 mounting flange to lip-over rough opening (to be 1/4" larger (min) than case size).
    b) Finish: case shall be Architectural grade powder coating. Interior of case shall be painted/powder coated white for optimum reflectivity
    c) Case shall be serviceable through the front.
    d) Case shall contain IP 66 minimum rated LED modules and power supply, in color temperature 5000k LED modules and power supplies shall be of a brand found in national sign supply distributors for ease of eventual replacement. LED spacing shall be laid-out to provide even illumination with no hot or dark spots.
    e) Case shall provide adequate water egress, and ventilation
    f) Clock crystal, in sizes less than 48" diameter, shall be 1/8" minimum thickness, tempered glass

2. Clock Dial:
    a) Number style
        1. Shall be selected from Manufacturers standard selection.
    b) Material:
        1. Flat .177 thick translucent white sign-grade (UV Protected) polycarbonate
        2. Specify numbers:
            a. ¼" thick plate aluminum numbers, powder coated and through-bolted to polycarbonate
    c) Clock dial shall be free to expand/contract with temperature, secured within a retainer to allow for such movement

3. Clock Hands:

a) Style : To be selected from Manufactures standard selection.
b) Fabricated .063 aluminum or #4 brushed stainless steel, balanced and rated for weather & exposure
c) Illuminated, halo-lit: Fabricated .063 aluminum or #4 brushed stainless steel with 1-1/2" returns, fully enclosed translucent white polycarbonate backs with IP 66 rated LED's
d) Finish: Architectural grade powder coated color

4. Clock Movement:
   a) Shall be rated by movement manufacturer for dial size

5. Fasteners:
   a) All fasteners to be of Stainless Steel throughout clock case
   b) All fasteners to be hidden from ground view

6. Automatic Master Clock controller:
   a) Internal quartz time-base
   b) 7-year lithium battery back-up memory
   c) Automatically reset the display clock(s) after power outages and Daylight Saving
   d) Programmable Daylight-Saving parameters
   e) 24v bi-polar output impulse
   f) Mounted in a NEMA wall-mounted enclosure, furnished with a 7' cord and UL Listed 120v/24v AC Class 2 50VA plug-in transformer

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions with installer present for compliance with requirements for supporting members, blocking, inserts, installation tolerances,

clearances, lighting and other conditions affecting exterior clocks installation or operations

B. Proceed with installation if conditions meet requirements

3.2 INSTALLATION

A. Install each item at locations indicated on drawings, as detailed and in accordance with manufacture's written instructions and recommendations. Provide accessories necessary for complete installation

B. Install exterior clocks after other finishing operations have been completed

C. Install exterior clocks securely connected to supports, and in proper relation to adjacent construction. Use mounting methods of types described and in compliance with approved shop drawings and fabricators written instructions

D. Anchoring to in-place constructions: Use anchors, fasteners, fittings, hardware and installation accessories for securing exterior clocks to the clock tower structure, properly transferring load to in-place construction

E. Install master clock controller in a convenient, accessible, secure, dry location

F. Connect clocks to master clock controller and electrical system in accordance with approved shop drawings

G. Seal all perimeter openings with glazing sealant or caulking

H. Test and calibrate entire clock system, verify GPS signal strength and accuracy with NIST

3.3 DEMONSTRATION AND TRAINING

A. Demonstrate functionality of clock system, operation and maintenance of exterior clocks and master clock controller to Owner's designated representative.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY:

A. Related work specified elsewhere:
   1. Gypsum Board Assemblies.
   2. Toilet compartments.

1.2 SUBMITTALS:

A. Product data: Include catalog cuts and data sheets indicating size, material and finish, complete parts list and installation procedures for each accessory. Where manufacturer's standard products vary with design criteria, indicate compliance with design criteria.

B. Samples: Submit one actual sample of each accessory for approval if requested by Architect. Upon approval, samples will be returned for incorporation into project.

1.3 JOB CONDITIONS:

A. Protection: Maintain manufacturer's protective covering on accessories until final cleanup of installation.

B. Coordinate this work with work of other trades into which accessories are to be installed.

1.4 DESIGN CRITERIA

A. In order to be acceptable, products shall comply with the following criteria:
   1. All accessories shall be products of a single manufacturer.
   2. Keying: Keyed accessories shall be keyed alike, unless otherwise specified.
   3. Operation: Control and operating mechanisms shall be operable with one hand, without tight grasping, pinching, or twisting of wrist, and with a maximum force of 5 lbf.

1.5 WARRANTY:

A. Mirrors: Warrant mirrors for fifteen years against silver spoilage.

PART 2 - PRODUCTS

2.1 TOILET ACCESSORIES:

A. Acceptable manufacturers; subject to compliance with specified design criteria:
   1. Bobrick Washroom Equipment, Inc. or approved equal (see drawings).

B. Accessories indicated on the drawings

C. Urinal Privacy Screen: Stainless Steel 24"W x 48"H (include continuous aluminum mounting kit hardware) provided by one of the following or approved equal.
   1. Bradley Products

2. Hardrain
3. ASi Global Partitions

D. Pipe Insulation: premoulded PVC insulating covers for drain and supply lines:
1. Brocar Products, Inc., Trap Wrap.
2. Truebro, Inc., Handi Lay—Guard
3. Approved equal

PART 3 - EXECUTION

3.1 EXAMINATION:

A. Check opening scheduled to receive recessed or semi—recessed accessories for correct dimensions, depth, plumbness of blocking or frames, and preparation that would affect installation of accessories.

3.2 INSTALLATION:

A. Install accessories level, plumb and in indicated location. Installation methods shall be as indicated in product data for substrates encountered. Securely attach to blocking or framing members.

B. Mounting heights: As indicated on drawings.

C. Grab bars:
1. Attach grab bars to masonry walls using 114” diameter stainless steel toggle bolts.
2. Attach grab bars to toilet partitions using wing tapped steel spacers and stainless steel machine screws. Where grab bar is attached to one side of partition only, spacer shall have minimum 16 ga. Satin finish stainless steel backup plate.

D. Conceal evidence of drilling, cutting and fitting to adjacent finishes.

E. Provide wood blocking for all installations of accessories on stud walls.

3.3 ADJUSTING AND CLEANING:

A. Adjust operating parts of accessories for proper operation.
B. Clean and polish exposed surfaces prior to Date of Substantial Completion.
C. Deliver accessory schedule, keys and parts manual as part of project closeout documents.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Contractor and Owner Furnished Products
   1. Residential Appliances.
   2. Commercial Laundry Appliances.
   3. Commercial Kitchen Appliances and fixtures
   4. Miscellaneous Other Product Used.

B. All products specified in part 2 below shall be provided by the Contractor, unless otherwise noted to be Owner Furnished, Contractor Installed.

1.2 SUBMITTALS

A. Section 01330 - Submittals: Procedures for submittals. Submit required submittals within 30 days after contract award.

B. Product Data: Submit manufacturer's specifications and installation instructions.

C. Certifications: Provide Energy Star certification for all appliances in this section.

1.3 DELIVERY, STORAGE, AND HANDLING

A. Receive Owner Furnished products in compliance with the requirements of Section 01640.

B. Acceptance at Site: inspect products upon delivery of products to Site to verify quantity of products furnished and shall report discrepancies in quantity delivered or obvious damage to products delivered to the site.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following or approved equal:
   1. General Electric
   2. KitchenAid
   3. Continental
   4. Elkay
   5. Bloomfield
   6. Vulcan
   7. Regency
   8. Larkin
   9. Ice-O-Matic
   10. Kraus
   11. InSinkErator
   12. Whirlpool
   13. Turbo-Air
   14. Frigidaire

2.2 RESIDENTIAL APPLIANCES

A. Garbage Disposal: 1/2 HP food waste disposer by InSinkErator model No. Badger 5 or approved equivalent.

2.3 RESIDENTIAL APPLIANCES (OWNER FURNISHED, CONTRACTOR INSTALLED)

A. Microwave: Frigidaire

B. Coffee Maker: Valculator

C. Refrigerator: GE stainless steel

D. Clothes Washer: Bob Bailey

E. Clothes Dryer: Bob Bailey

2.4 COMMERCIAL LAUNDRY APPLIANCES (OWNER FURNISHED, CONTRACTOR INSTALLED)

A. Washer Extractor: **85 lb** capacity high performance by UNIMAC Model UWT085D40V

B. Drying Cabinet: UNIMAC Model UTGC6EDG64 Gear Dying Cabinet

C. Dishwasher: Hobart model AM15VL Ventless Door- type Dishwasher
   1. Accessories: As furnished including, but not limited, to items indicated below
      a. Peg leg
      b. combination rack
      c. Splash shield for corner installation
      d. flanged and seismic feet
      e. drain water tempering kit

2.5 COMMERCIAL KITCHEN APPLIANCES AND FIXTURES

A. Range: 60” gas range by Vulcan Model 60SS-6B24GBN or approved equivalent.

B. Char Broiler: 24” gas Model SRCB-24 by Sierra Range or approved equivalent.

C. Sink: 14” deep Stainless steel 3 compartment sink with 18” double drainboard

D. Sink faucet: wall mounted swivel with 8” center and 12” swing spout by Elkay Model No LK940HA10L2S or approved equivalent.

E. Kitchen hood: hood as indicated on drawings

2.6 COMMERCIAL KITCHEN APPLIANCES AND FIXTURES (OWNER FURNISHED, CONTRACTOR INSTALLED)

A. Ice Maker: Ice-O-Matic

2.7 MISCELLANEOUS OTHER PRODUCTS USED

A. Splash Guard: Provide 22 gauge stainless steel sheet metal, cut to fit, with smooth edges at the following locations:
   1. Behind range/stove

2. Sides of adjacent wall cabinets (where millwork/casework is specified to be other than stainless steel).

B. Equipment Stand (for char broiler): 30” x 36” stainless steel with open base and bottom shelf.

C. Prep Table: 36”x72” stainless steel prep table with open base.

D. Dish Table: 16 ga stainless top, 10” high backsplash with 2” return, galvanized legs with adjustable plastic feet
   1. CDT-48-LX by Elkay or approved equivalent
   2. CDT-48-RX by Elkay or approved equivalent

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas where appliances will be installed. Do not proceed with Work until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install appliances where and as shown and according to manufacturer's written instructions.

END OF SECTION

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 venetian blinds.

1.3 SUBMITTALS

A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.

B. Product data for each type of horizontal louver blind specified. Include printed data on physical characteristics.

C. Shop drawings showing location and extent of blinds. Show installation details at and relationship to adjoining work. Include elevations indicating blind units. Indicate location of blind controls.

D. Samples for initial selection in the form of manufacturer's color charts showing the full range of colors, textures, and patterns available for each type of horizontal louver blind indicated.

E. Samples for verification of the following products, in manufacturer's standard sizes, showing the full range of color, texture, and pattern variations expected. Prepare samples from the same material to be used for the Work.

1. Louver: Manufacturer's standard-size unit, not less than 12 inches (300 mm) long.
2. Valance: Manufacturer's standard-size unit, not less than 12 inches (300 mm) long.

F. Schedule of horizontal louver blinds using same room designations indicated on Drawings.

G. Maintenance data for horizontal louver blinds to include in the operation and maintenance manual specified in Division 1. Include the following:

1. Methods for maintaining horizontal louver blinds and finishes.
2. Precautions for cleaning materials and methods that could be detrimental to finishes and performance.

1.4 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: Provide horizontal louver blinds identical to those tested for the following fire-test-response characteristics as determined by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.

1. Test Method: NFPA 701.
2. Rating: Pass.

B. Single-Source Responsibility: Obtain each type of horizontal louver blind from one source and by a single manufacturer.

1.5 PROJECT CONDITIONS

A. Field Measurements: Check actual horizontal louver blind dimensions by accurate field measurements before fabrication, and show recorded measurements on final shop drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

B. Space Enclosure and Environmental Limitations: Do not install horizontal louver blinds until space is enclosed and weatherproof, wet-work in space is completed and nominally dry, work above ceilings is complete, and ambient temperature and humidity conditions are and will be continuously maintained at values near those indicated for final occupancy.

1.6 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed, are packaged with protective covering for storage, and are identified with labels clearly describing contents.

1. Horizontal Louver Blinds: Before installation begins, furnish quantity of full-size units equal to 5 percent of amount of each size installed.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include, but are not limited to, the following:

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

1. Horizontal Louver Blinds:

a. Eastern Standard Corp.
b. Faber.
c. Hunter Douglas, Inc.
d. Joanna Western Mills Co.
e. Kirsch.
f. Levolor Corp.
g. Louverdrape, Inc.
h. Nanik.
i. Springs Window Fashions Division, Inc.; (Bali-Graber).
j. Verosol USA, Inc.
K Or Equal

2.2 HORIZONTAL LOUVER BLINDS

A. Louvers: Manufacturer's standard as follows:

1. Aluminum.

    a. Perforated: Openness factor of 6 percent.

2. Nominal Louver Width: 1 inch (25 mm) (miniblinds).

B. Tilt Operation: Manual with wand.

C. Cord-Lock Operation: Cord lock; locks pull cord to stop blind at any position in ascending or descending travel.

D. Cord Equalizers: Self-aligning to maintain horizontal louver blind position.

E. Valance: Match color of louvers.

F. Mounting: As indicated.

G. Colors and Patterns: Where manufacturer's standard products are indicated, provide horizontal louvers complying with the following requirements:

1. Provide Architect's selections from manufacturer's full range of colors and patterns for horizontal louver blinds of type indicated.

2.3 FABRICATION

A. Product Standard and Description: Comply with AWCMA Document 1029 for each horizontal louver blind unit consisting of louvers, rails, cord locks, tilting mechanisms, tapes, and installation hardware.

B. Lifting and Tilting Mechanisms: Noncorrosive, self-lubricating materials.

C. Unit Sizes: Obtain units fabricated in sizes to fill window and other openings as follows, measured at 74 deg F (23 deg C):

1. Blind Units Installed Between (Inside) Jambs: Width equal to 1/4 inch (6 mm) per side or 1/2 inch (12 mm) total, plus or minus 1/8 inch (3 mm), less than jamb to jamb dimension of opening in which each blind is installed. Length equal to 1/4 inch (6 mm), plus or minus 1/8 inch (3 mm), less than head to sill dimension of opening in which each blind is installed.
2. Blind Units Installed Outside Jambs: Width and length as indicated, with terminations between blinds of end-to-end installations at centerlines of mullion or other defined vertical separations between openings.

D. Electric Motors: UL-approved, low-voltage motor with thermal overload switch; sized by blind manufacturer for installation indicated.

E. Installation Fasteners: Not less than 2 fasteners per bracket, fabricated from metal noncorrosive to blind hardware and adjoining construction; support blind units under conditions of normal use.

F. Hold-Down Brackets: Manufacturer's standard, as indicated.

G. Side Channels: Manufacturer's standard, as indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of horizontal louver blinds. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install blinds level, plumb, and located so exterior louver edges in any position are not closer than 1 inch (25 mm) to interior face of glass lites.

1. Flush Mounted: Install blinds with louver edges flush with finish face of wall.

3.3 ADJUSTING

A. Adjust components and accessories for proper operation.

3.4 CLEANING

A. Clean blind surfaces, according to manufacturer's instructions, after installation.

B. Remove surplus materials, packaging, rubbish, and debris resulting from installation. Leave installation areas neat, clean, and ready for use.

3.5 PROTECTION

A. Provide final protection and maintain conditions in a manner acceptable to manufacturer and Installer that ensure that horizontal louver blinds are without damage or deterioration at the time of Substantial Completion.

END OF SECTION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Enclosed Vertical Wheelchair Lift.

1.2 RELATED SECTIONS

A. Section 03300 - Cast-In-Place Concrete: Concrete shaftway and anchor placement.

B. Section 04200 – Unit Masonry Assemblies: Masonry shaftway and anchor placement.

C. Division 16 - Electrical: Lighting and wiring connections at top of shaft.

D. Division 16 - Electrical: Electrical power service and wiring connections.

1.3 REFERENCES

A. ASME A17.1 - Safety Code for Elevators and Escalators.

B. ASME A17.5 - Elevator and Escalator Electrical Equipment.

C. ASME A18.1 - Safety Standard for Platform Lifts and Stairway Chairlifts.

D. CSA B44 - Safety Code for Elevators and Escalators.

E. CSA B355 - Lifts for Persons with Physical Disabilities.

F. ICC/ANSI A117.1 - Accessible and Usable Buildings and Facilities.

G. NFPA 70 - National Electric Code.

H. CSA - National Electric Code.

1.4 SUBMITTALS

A. Submit under provisions of Section 01300.

B. Product Data: Manufacturer's data sheets on each product to be used, including:
   1. Submit manufacturer's installation instructions, including preparation, storage and handling requirements.
   2. Include complete description of performance and operating characteristics.
   3. Show maximum and average power demands.

C. Shop Drawings:
   1. Show typical details of assembly, erection and anchorage.

2. Include wiring diagrams for power, control, and signal systems.
3. Show complete layout and location of equipment, including required clearances and coordination with shaftway.

D. Selection Samples: For each finished product specified, provide two complete sets of color chips representing manufacturer's full range of available colors and patterns.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Firm with minimum 10 years experience in manufacturing of vertical platform lifts, with evidence of experience with similar installations of type specified.

B. Installer Qualifications: Licensed to install equipment of this scope, with evidence of experience with specified equipment. Installer shall maintain an adequate stock of replacement parts, have qualified people available to ensure fulfillment of maintenance and callback service without unreasonable loss of time in reaching project site.

1.6 REGULATORY REQUIREMENTS

A. Provide platform lifts in compliance with:
1. ASME A18.1 - Safety Standard for Platform Lifts and Stairway Chairlifts.
2. ASME A17.1 - Safety Code for Elevators and Escalators.
3. ASME A17.5 - Elevator and Escalator Electrical Equipment.
4. NFPA 70 - National Electric Code.

B. Provide platform lifts in compliance with:
1. CSA B355 - Lifts for Persons with Physical Disabilities.
2. CSA B44.1/ASME A17.5 - Elevator and Escalator Electrical Equipment.
3. CSA - National Electric Code.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

B. Store components off the ground in a dry covered area, protected from adverse weather conditions.

1.8 PROJECT CONDITIONS

A. Do not use wheelchair lift for hoisting materials or personnel during construction period.

1.9 WARRANTY

A. Warranty: Provide a two year limited warranty for wheelchair lift materials and workmanship.

B. Extended Warranty: Provide an extended manufacturer's warranty covering the wheelchair lift materials and workmanship for the following additional extended period beyond the initial two year warranty. Preventive Maintenance Agreement required.
1. Five Years (7 years total).

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturer: Garaventa Lift; United States - P.O. Box 1769, Blaine, WA 98231-1769. Canada - 18920 - 36th Ave., Surrey, BC V3Z 0P6. ASD. Toll Free: 800-663-6556. Tel: (604) 594-0422. Fax: (604) 594-9915. Email:productinfo@garaventalift.com. Web:www.garaventalift.com. (Design Model)

B. Approved Equal (coordinate pit dimensions)

2.2 ENCLOSED VERTICAL WHEELCHAIR LIFT

A. Capacity: 750 lbs (340 kg) rated capacity.

B. Mast Height:
1. 171 inches (4343 mm) maximum lifting height, using hydraulic drive, only.

C. Nominal Clear Platform Dimensions:
1. Standard: 37-1/4 inches (947 mm) by 54 inches (1370 mm).

D. Platform Configuration:
1. On/Off Same Side Entry/Exit: One front opening only.

E. Landing Openings:
1. Lower Landing: Door.
2. Upper Landing: Door.

F. Doors and Gates: Doors and gates shall be self closing type.
1. Door Height: Flush mount, 80 inches (2032 mm).
2. Door Construction: Aluminum frame with:
   a. Panels of 16 gauge (1.5 mm) painted galvanized steel.
   b. D-Handle Pull: 12 inch (305 mm) offset D-Handle.

G. Lift Components:
1. Machine Tower: Custom aluminum extrusion.
2. Base Frame: Structural steel.
3. Platform Side Wall Panels: 42-1/8 (1070 mm) inches high. 16 gauge (1.5 mm) galvanized steel sheet. Custom aluminum extrusion tubing frame.
4. Enclosure Panels:
   a. 16 gauge (1.5 mm) painted galvanized steel sheet.

H. Enclosure Height Above Upper landing:

1. Enclosure shall extend 83-3/4 inches (2127 mm) above the upper landing level.

I. Infill Panel Kit: Provide 16 gauge (1.5 mm) galvanized panels and mounting hardware to cover void between side of enclosure, drive mast and adjacent wall at the following locations:
   1. Lower landing.
   2. Upper landing.

J. Base Mounting and Access to Lift at Lower Landing:
   1. Pit Mount: Lift to be mounted in pit with dimensions to meet manufacturers requirements for the platform size specified. Pit construction shall be in accordance to Section 03300.

K. Hydraulic Drive:
   1. Drive Type: Chain hydraulic.
   2. Emergency Operation: Manual device to lower platform and use auxiliary battery power to raise or lower platform.
   3. Safety Devices:
      a. Slack chain safety device.
      b. Shoring device.
   4. Travel Speed: 17 fpm (5.2 m/minute).
   5. Motor: 3.0 hp (2.2 kW); 24 volts DC.
   6. Power Supply:
      a. 120 VAC single phase; 60 Hz on a dedicated 15 amp circuit.
      b. Powered by building continuous mains converted to 24 VDC and equipped with auxiliary battery backup power system capable of running lift up and down for a minimum of 5 trips with rated load. Required for high use lifts and lifts equipped with a fan and ventilation system.

L. Platform Controls: 24 VDC control circuit with the following features.
   1. Direction Control: Illuminated tactile and constant pressure push buttons with dual platform courtesy lights and safety light.
   2. Illuminated and audible emergency stop switch shuts off power to lift and activates audio alarm equipped with battery backup.
   3. Keyless operation.
   4. Arrival Gong and Digital Floor Display.

M. Call Station Controls: 24 VDC control circuit with the following features.
   1. Direction Control: Illuminated tactile and constant pressure push buttons with illuminated "In Use" indicator.
   2. Keyless operation.
   3. Call Station Mounting:
      a. Lower:
         1) Frame mounted.
      b. Intermediate:
         1) Frame mounted.
      c. Upper:
         1) Frame mounted.

N. Safety Devices and Features:
   1. Grounded electrical system with upper, lower, and final limit switches.
   2. Tamper resistant interlock to electrically monitor that the door is in the closed position and the lock is engaged before lift can move from landing.

O. Finishes
1. Aluminum Extrusions: Champagne anodized finish.
2. Ferrous Components: Electrostatically applied baked powder finish, fine textured.
a. Color: Satin Grey, RAL 7030. (or approved substitution)

EXECUTION

2.3 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. Verify shaft and machine space are of correct size and within tolerances.

C. Verify required landings and openings are of correct size and within tolerances.

D. Verify electrical rough-in is at correct location.

E. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

2.4 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

2.5 INSTALLATION

A. Install lifts in accordance with applicable regulatory requirements including ASME A 17.1, ASME A 18.1 and the manufacturer's instructions.

B. Install lifts in accordance with applicable regulatory requirements including CSA B355, and manufacturer's instructions.

C. Install system components and connect to building utilities.

D. Accommodate equipment in space indicated.

E. Startup equipment in accordance with manufacturer's instructions.

F. Adjust for smooth operation.

2.6 FIELD QUALITY CONTROL

A. Perform tests in compliance with ASME A 17.1 or A18.1 and as required by authorities having jurisdiction.

B. Perform tests in compliance with CSA B355 and required by authorities having jurisdiction.

C. Schedule tests with agencies and Architect, Owner, and Contractor present.

2.7 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Special Conditions (Exhibits A and B), apply to this Section.

1.2 SECTION INCLUDES

A. This division and the accompanying drawings cover furnishing of all labor, equipment, appliances and materials and performing all operations in connection with the installation of complete HVAC, Plumbing and Fire Protection systems as specified herein and as shown on the drawings.

B. The general provisions of the contract including Division 1 and other divisions are appropriate, apply to work specified in this division.

1.3 CODES AND REGULATIONS

A. All mechanical equipment and workmanship shall comply with the following codes and standards as applicable.

1. International Building Code (2012 Edition) with Georgia & City of Atlanta Amendment.
2. International Mechanical Code (2012 Edition) with Georgia Amendment.
3. Life Safety Code : (NFPA 101) 2012 Edition with Georgia State Amendments 2013.
4. Georgia Handicapped Accessibility Law 120-3-20.
5. International Plumbing Code (2012 Edition) with Georgia Amendments.
6. International Fuel Gas Code 2012 Edition with Georgia Amendments
7. International Energy Code 2009 Edition with Georgia Supplements and Amendments
8. National Electric Code 2017 Edition with no Georgia Amendments
9. American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE).
10. American National Standards Institute (ANSI).
11. American Society of Mechanical Engineers (ASME).
12. t.

B. Applicable Publications:

The publication listed below form a part of this specification to the extent referenced and are referred to in the text by the basic designation only.

1. Air Conditioning and Refrigeration Institute Standards (ARI).
2. American Air Balance Council (AABC).
3. American National Standards Institute, Inc. Standards (ANSI).
4. American Society for Testing and Materials Publications (ASTM).
5. American Society of Mechanical Engineers Code (ASME).
6. American Gas Association (AGA).
7. National Fire Protection Association Standard (NFPA).
8. Sheet Metal and Air Conditioning Contractor's National Association, Inc. (SMACNA).

9. Underwriters Laboratories, Inc. (UL)
10. Factory Mutual Underwriters (FM). Factory Mutual Approval Guide.

C. All work done under this Contract shall comply with all state and local codes having jurisdiction and with the requirements of the Utility Companies whose services may be included. All modifications required by these codes shall be made by the Contractor without additional charges. Where code requirements are less than those shown on the Plans or in the Specifications, the Plans and Specifications shall be followed. Where applicable, NFPA requirements shall be met.

D. In case of any conflicts between contract documents, the stricter/more stringent shall govern.

E. The Contractor shall obtain all permits, inspections, and approvals as required by all authorities having jurisdiction and deliver certificates of approval to the Engineer. All fees and costs of any nature whatsoever incidental to these permits, inspections and approvals must be assumed and paid by the Contractor.

F. The Contractor shall comply with all applicable provisions of the William-Steiger Occupational Safety and Health Act (O.S.H.A.).

G. Wormanship and Materials: The workmanship and materials covered by these specifications shall conform to all ordinances and regulations of the city, county and/or other authorities having jurisdiction.

H. Contractor shall visit the site and examine existing conditions before submitting bid. No allowance will be made for lack of knowledge of existing conditions when such conditions can be determined by observation.

1.4 SUBMITTALS

A. The Contractor shall submit for review by the Architect data of materials and equipment to be incorporated in the work. Submittals shall be supported by descriptive material, catalogs, cuts, diagrams, performance curves and charts published by the manufacturer to show conformance to specification and drawing requirements; model numbers alone will not be acceptable.

B. Refer to the individual sections for identified equipment and materials for which submittals are required.

C. Refer to Division 1 for required procedures.

D. Substitutions: Refer to Division 1 for required procedures.

E. Mechanical Equipment Electric Data: Prior to submitting data for equipment requiring electrical service, the Contractor shall verify that electrical characteristics of equipment submittals comply with electrical service provided for the specified items of equipment.

F. Upon receipt of the Contractor of reviewed submittals for equipment provided under this Division, the Contractor shall coordinate the electrical service requirements, i.e., motor horsepower and full load amps, electrical service characteristics (voltage and phase), and number of services for each item of equipment requiring electrical connections with the electrical drawings and specifications.

G. Items on or projecting through the ceiling and the roof shall be coordinated with other trades.

1.5 OPERATION AND MAINTENANCE INSTRUCTIONS

A. Refer to Division 1 for Detail Requirements.

B. The Contractor shall provide five Operation and Maintenance Manuals. The manuals shall be compiled in hard back, three ring note books. O&M manuals shall have permanent labels on front and side. The following information shall appear in each manual:

1. Description of function, normal operating characteristics and limitations, performance curves, engineering data and tests, complete nomenclature and commercial numbers of replacement parts for each piece of equipment.
2. Manufacturer's printed operating procedures to include start-up, break-in, routine and normal operating instructions; regulation, control, stopping, shutdown and emergency instructions; and summer and winter operating instructions.
3. Maintenance procedures for routine preventative maintenance and trouble shooting, disassembly, repair and reassembly; aligning and adjusting instructions.
4. Servicing instructions and lubrication charts and schedules.
5. Complete "as built" control diagrams showing cooling, heating and fire emergency systems. Clearly label equipment and/or device number, manufacturer, model number and function.
6. Complete "as built" sequence of operation describing cooling, heating and fire emergency modes. Clearly reference equipment valves, relays, interlocks sensors and control devices illustrated in control diagrams.
7. Piping diagrams for mechanical rooms.

C. The HVAC O&M manual shall be customized for each specific project and act as an easy-to-follow stand-alone operation guide for the building operator.

D. The Contractor shall turn O&M manuals over to the Engineer and shall be reviewed and approved prior to final pay application. The Program Manager shall turn over all five (5) O&M manuals over to the Owner.

1.6 INSTRUCTIONS OF OWNER PERSONNEL

A. Before final inspection, at a time designated by the Designer, provide a competent representative to instruct Owner's designated personnel in operation, adjustment and maintenance of products, equipment and systems under this Division of the specifications. For equipment requiring seasonal operations, perform instructions for other seasons within six months unless requested otherwise.

B. Prepare and insert additional data in Operations and Maintenance Manual when needed, for such data becomes apparent during instructions.

C. The Contractor shall prepare and submit a comprehensive plan for the training of the Owner's personnel on all equipment provided under this section of the specification. This plan shall include a list of the equipment, the dates that training shall be provided and the manufacturers who will be providing each portion of the training. This plan shall be submitted to the Owner and approved, at least 30 days prior to the time that the training is scheduled to begin. All training sessions will be conducted by using the actual Operations and Maintenance Manuals which are provided by the Contractor on this project.

D. The following items shall be discussed for each piece of equipment:

1. Sequence of normal operation for cooling and/or heating modes
2. Routine maintenance schedule

3. Location and operation of resets
4. Location and operation of overrides
5. Location and operation of overrides
6. Location of service valves
7. Areas served by equipment

1.7 RECORD DOCUMENTS

A. Refer to Division 1 for record documents and related submittals.

1.8 CERTIFICATES

A. The Contractor shall assemble and submit a single comprehensive listing of all installation certifications which are required to be provided to the Owner at the completion of the project.

1.9 RECORD DRAWINGS

A. The Contractor shall maintain on a daily basis at the project site a complete set of "Record Drawings", reflecting an accurate dimensional record of all buried or concealed work. In addition, the "Record Drawings" shall be marked to show the precise location of concealed work and equipment, including concealed or embedded piping and valves and all changes and deviations in the Mechanical work from that shown on the Contract Documents. This requirement shall not be construed as authorization for the Contractor to make changes in the layout or work without definite instructions from the Architect.

B. Record dimensions shall clearly and accurately delineate the work as installed; locations shall be suitably identified by at least two (2) dimensions to permanent structures.

C. The Contractor shall mark all "Record Drawings" on the front lower right hand corner with a rubber stamp impression that states the following:
"RECORD DRAWINGS (3/8" high letters)
To be used for recording Field Deviations and Dimensional Data Only". (5/16" high letters)

D. Payment requisition will not be approved if the drawings are not kept current.

E. Prior to leaving the job site once the work is complete, the Contractor shall furnish to the Engineer a complete marked-up mylar sepia set of final record drawings.

PART 2 - PRODUCTS

2.1 COORDINATION

A. The products of particular manufacturers have been used as the basis of design in preparation of these documents. Any modifications to the mechanical systems and their components, the electrical systems, the building structure and architecture, or any other portion of the building that result from the use of any other than that basis of design equipment shall be coordinated with all other trades. Such coordination shall occur before delivery of products from the manufacturer (before shop drawings submittals) and shall be clearly indicated on the shop

drawings. Any related modifications shall be performed without any additional cost to the Contract.

2.2 DESCRIPTION

A. All products shall be new and bear the Underwriter's Laboratories, Inc. (UL) label where applicable unless specifically indicated otherwise.

B. No product or material containing asbestos shall be used.

PART 3 - EXECUTION

3.1 GENERAL

A. The plans do not give exact elevations or locations of lines, nor do they show all the offsets, control lines, or other installation details. The Contractor shall carefully lay out his work at the site to conform to the structural conditions, to provide proper grading of lines, to avoid all obstructions, to conform to details of installation supplied by the manufacturers of the equipment to be installed, to coordinate with other trades in the same space and to thereby provide an integrated, coordinated and satisfactory operating installation. Do not scale drawings.

B. If the Contractor proposes to install equipment, including piping and ductwork, requiring space conditions other than those shown, or to rearrange the equipment, he shall assume full responsibility for the rearrangement of the space and connect arrangement at no additional cost to the Owner, and shall have the Engineer review the change before proceeding with the work. The request for such changes shall be accomplished by shop drawings of the space in question.

C. The Contractor is responsible for the proper location and size of all slot, holes or openings in the building structure pertaining to his work, and for the correct location of sleeves, inserts, cores, etc.

D. The Contractor shall so coordinate the work of all trades that it may be installed in the most direct and workmanlike manner without hindering or handicapping the other trades. Piping interferences shall be handled by giving precedence to pipe lines which require a stated grade for proper operation. For example sewer lines and condensate piping shall take precedence over water lines in determination of elevations. Where there is interference between sewer lines and condensate lines, the sewer lines shall have precedence and provisions shall be made in the condensate lines for looping them around the sewer lines. In all cases, lines requiring a stated grade for their proper operation shall have precedence over electrical conduit and ductwork.

E. All piping and ductwork in finished areas, except where noted to the contrary, shall be installed in chases, furred spaces, above ceilings, etc. In all cases, pipes and ducts shall be installed as high as possible. Runs of piping shall be grouped whenever it is feasible to do so.

F. Piping shall be installed to pass inspections by local plumbing inspection department, state and federal authorities and insurance company having jurisdiction. Any changes or additions, which may be necessary to obtain such inspections and approval, shall be made by the Contractor as part of this Contract and without additional cost to the Owner.

G. Piping, ductwork or equipment shall not be installed in electrical equipment rooms or elevator machine rooms except as serving only those rooms. Outside of electrical equipment rooms, do not run piping or ductwork or locate equipment, with respect to switchboards, panelboards, power panels, motor control centers, dry type transformers.
   1. Within 42" in front (and rear if free standing) of equipment; or
   2. Within 36" of sides of equipment. Clearances apply vertically from floor to structure.
   3. Provide access to equipment and apparatus requiring operation, service or maintenance within the life of the system. Including, but not limited to, motors, valves, filters, dampers, shock absorbers, etc. Equipment located above lay-in type ceilings is considered accessible.

3.2 ELECTRICAL WORK

A. All electrical equipment provided under this Division shall comply with the electrical system characteristics indicated on the Electrical Drawings and specified in Division 16.

B. Equipment unit motor speed controls, starters, system controls, pilot lights, push-buttons, etc., shall be furnished complete as a part of the motor apparatus which it operates. All components shall be in conformance with the requirements of the National Electrical Code and Division 16. All motor starters shall be provided with an H-O-A switch and control transformer. All starters and disconnect switches for mechanical equipment shall be furnished under Division 15 and installed by the electrical contractor. Coordinate installation with Electrical Contractor prior to his wiring of equipment.

C. All power wiring and final power connections to the system shall be provided under Division 16.

D. Control wiring (120V and less) shall be provided under Division 15 and extended from the starters, control transformers or 120V power circuits indicated on the Electrical Drawings. Interlock circuits for motorized damper and HVAC and fire alarm interlocks shall be provided by the mechanical contractor. All wiring for voltages higher than 25 volts shall be done by a licensed electrician.

E. All electrical characteristics shall be taken from the Electrical drawings and Specifications and coordinated before equipment is ordered or submitted.

3.3 MOTORS

A. Unless specifically noted otherwise in other sections of this Specification, all motors and motor controls shall meet the requirements specified in this Section. All motors shall be built in accordance with the current applicable IEEE, and NEMA standards and shall have voltage, phase, frequency and service as scheduled. All motors 1 HP and larger shall be high efficiency type. Under no circumstance shall the efficiency be less than the 1996 North Carolina Energy Code.

B. Each motor shall be suitable for the brake horsepower of the driven unit, rated with 1.15 minimum service factor, and shall be NEMA design B. The motor temperature rise shall not exceed 72 degrees F for drip proof motors, 90 degrees F for splash proof motors, and 99 degrees F for totally enclosed or explosion proof motors. The motor shall be capable of operating continuously at such temperature rises, and shall be capable of withstanding momentary overloads of 25 percent without injurious overheating.

C. Each item of motor driven equipment shall be furnished complete with the motors, drives and starters as required to perform the specific function for which it is intended, scheduled and specified.

D. Motors shall be ball bearing type selected for quiet operation and shall be manufactured for general purpose duty unless otherwise indicated. Each bearing shall be accessible for lubrication and designed for the load imposed by the V-belt drive or the driven apparatus. Direct drive motors shall be designed for the specific application with all necessary thrust bearings, shaft capacities, etc.

E. Motors larger than 1/2 horsepower shall have bearings with pressure grease lubrications fittings or shall be permanently sealed type.

F. Motors connected to drive equipment by belt shall be furnished with adjustable slide rail bases except for fractional horsepower motors which shall have slotted bases. Motor leads shall be permanently identified and supplied with connectors.

G. Each motor to be installed outdoors shall be of the totally-enclosed fan-cooled type, or housed in a weatherproof housing.

H. Unless otherwise indicated, motors smaller than 1/2 horsepower shall be capacitor start or split phase type designed for 120 volt, single phase, 60 cycle alternating current. Shaded pole motors are not acceptable except 35 watts and smaller. Motor 1/2 horsepower and larger shall be squirrel cage induction type, 3 phase, 60 cycle alternating current.

I. Multi-speed motors shall, except as noted, be consequent pole, variable torque, single winding. When the speed ratio or the load characteristic dictates, the multi-speed motors shall be separate winding types. Variable speed motors operating over an adjustable range of speeds shall be motors specifically designed and rated for this duty.

J. If the Contractor proposed to furnish motors varying in horsepower and/or characteristics from those specified, he shall first inform the Engineer of the change and shall then coordinate the change and shall pay all additional charges in connection with the change.

3.4 PROTECTION OF EQUIPMENT

A. Store equipment, including pipe and valves, off the ground and under cover. For storage outdoors, minimum 4 mil thick plastic shall be fitted to withstand spattering, ground water, precipitation and wind.

B. Plug ends of pipe when work has stopped and close ends of ducts with plastic taped in place until work resumes.

C. Damaged equipment shall be repaired or replaced at the option of the Architect.

3.5 PAINTING

A. Factory painted equipment that has been scratched or marred shall be repainted to match original factory color.

B. All uninsulated black ferrous metal items exposed to sight inside the building, such as piping, equipment hangers and supports not provided with factory prime coat, shall be cleaned and painted with one coat of zinc chromate primer. In addition, such items in finished spaces shall

also be painted with two coats of finish paint in a color to match adjacent surfaces or as otherwise selected by the Architect.

C. Black ferrous metal items exposed outside the building, such as uninsulated pipe and pipe supports not provided with factory prime coat, shall be cleaned and painted with one coat of rust inhibiting primer and two coats of an asphaltic base aluminum paint. Insulated pipes outside the building shall be cleaned and painted with one coat of rust inhibiting primer before installing insulation.

D. All hanger rods shall be galvanized.

E. No nameplates or equipment shall be painted, and suitable protection shall be afforded to the plates to prevent their being rendered illegible during the painting operation.

3.6 PROTECTION OF EXISTING UTILITIES

A. The Contractor shall use extreme caution during excavation operations not to damage or otherwise interrupt the operations of existing utilities. The Contractor shall be responsible for the continuous operation of these lines and shall provide bypasses or install such shoring, bracing or underpinning as may be required for proper protection.

B. Coordinate all activities around existing utility line with the appropriate utility.

3.7 CUTTING AND PATCHING

A. The Contractor shall assume all cost of, and be responsible for, arranging for all cutting and patching required to complete the installation of his portion of the Work. All cutting shall be carefully and neatly done so as not to damage or cut away more than is necessary of any existing portions of the structure.

B. All surfaces shall be patched to the condition of the adjacent surfaces.

C. The Contractor shall make suitable provisions for adequately waterproofing at his floor penetrations of water proof membrane floors. This shall include but not be limited to floor drains, open sight drains, hub drains, cleanouts, and sleeves for the various piping. This also applies to membrane roofing systems.

D. All penetrations and water proofing of penetrations in membrane roofing systems shall be coordinated with and performed by the manufacturer/installer.

E. Cutting and drilling of precast concrete structure is prohibited.

F. Cutting and patching of any metal or concrete beam is prohibited

3.8 SLEEVES, FLOOR AND CEILING PLATES

A. The Contractor shall install, as required, in concrete, carpentry or masonry construction, all necessary hangers, sleeves, expansion bolts, inserts and other fixtures and appurtenances necessary for the support of pipe, duct, equipment and devices furnished under each section of the Specification.

B. Cutting of openings, and installation of sleeves or frames through walls and surfaces shall be done in a neat workmanlike manner. Openings shall be cut only as large as required for the installation; sleeves, except as otherwise indicated, and/or frames shall be installed flush with finished surfaces and grouted in place. Surfaces around openings shall be left smooth and finished to match surrounding surface.

C. Where pipes pass through floor slabs, sleeves shall be standard weight black steel pipe with top of sleeve 1 1/2" above finished floor. Where pipes pass through walls, sleeves shall be standard weight black steel pipe or 20-gage galvanized sheet metal with ends flushed with wall surfaces.

D. Each pipe or duct passing through walls, floors, ceilings or partitions shall be provided with sleeves having internal diameters one inch larger than the outside dimensions of insulated pipes or ducts.

E. Contractor is responsible for coring of all floors and walls. Coordinate location of cores with existing structure. Do not core through existing beams or joists.

F. All pipe sleeves through floors, roofs and masonry walls shall be built in place as the affected walls, floors and roofs are built.

G. All penetrations through rated floors and walls shall be sealed with an UL approved fire stop system as manufactured by 3M, Dow, Proset or Hilti. Install complete firestop system in accordance with manufacturer's instructions. See Attachment A for firestop details.

H. Sleeves through exterior wall shall be steel or cast iron pipe, flush with the exterior surfaces, and with the space between the pipe and the sleeves caulked watertight in approved manner.

I. Inserts shall be cast iron or galvanized steel individual type, with accommodations for removable nuts and threaded rods up to 3/4 inch diameter, and permitting lateral adjustment.

3.9 ESCUTCHEONS

A. Escutcheons shall be installed on all pipes where they pass through floors, ceilings, walls or partitions in finished areas where exposed to view.

B. The interior of closets, adjacent to finished areas, shall be considered as finished for the intent of these Specifications.

C. Escutcheons shall be split, hanged, stamped brass type designed to fit the pipe, and to cover the terminating pipe sleeve, in chrome plated finish unless otherwise specified, with securing device to hold the escutcheon tight to the pipe.

3.10 CLEANING AND ADJUSTING

A. The Contractor shall provide and install all necessary temporary connections, strainers and other equipment to thoroughly clean the piping systems before start-up. The Contractor is responsible for disposing of all cleaning agents and removing all temporary connections and strainers after cleaning is complete.

B. Remove all stickers, rust, stains, labels and temporary covers before final acceptance.

C. The exterior surfaces of all mechanical equipment, piping, etc., shall be cleaned of all grease, oil, paint, dust and other construction debris.

D. Bearings that require lubrication shall be lubricated in accordance with the manufacturer's recommendations. Provide written certification of lubrication.

E. Ducts, plenums and casings shall be cleaned of all debris and blown free of all particles of rubbish and dust before installing outlet faces.

F. Temporary filters shall be provided for fans that are used during construction. At the time of starting the balancing of the air distribution system, new filters shall be installed.

G. Equipment rooms shall be left broom clean.

H. Ends of open pipes shall be covered during construction except when working directly on such end prohibits covering. Cover with minimum four (4) mil thick polyethylene taped, tied or wired in place.

I. Clean and polish identification plates.

3.11 GUARANTEE

A. All systems and components shall be provided with a one year guarantee from the time of final acceptance of beneficial occupancy (Coordinate with the General Conditions). All compressors shall carry a five (5) year warranty. The guarantee shall cover all materials and workmanship. During this guarantee period, all defects in materials and workmanship shall be corrected by repair or replacement without incurring additions to the Contract.

3.12 FOUNDATIONS

A. All concrete foundations required by equipment furnished under the Mechanical Division shall be reinforced and constructed in conformance with the recommendations of the manufacturer of the respective equipment actually applied, and with the approval of the Architect. All corners of the foundations shall be neatly chamfered. Foundation bolts shall be placed in the forms when the concrete is poured. Allow one inch (1") below the equipment bases for alignment, leveling and grouting with non-shrinking grout. Grouting shall be done after the equipment is leveled in place. After the grout has hardened, the foundation bolts shall be pulled up right and the equipment shimmed, if necessary. After removal of the forms, the surface of the foundations shall be rubbed. Unless otherwise noted, foundations shall be four inches (4") high and shall extend 6" beyond edge of equipment. All concrete work performed shall conform entirely to the requirements of the General Specifications which describe this class of work.

3.13 INSTALLATION

A. All equipment shall be installed in strict conformance with code requirements and manufacturer's recommendations, as specified herein and as shown. If any conflict arises between these instructions, notify the Architect immediately for guidance.

B. The Contractor shall notify the Owner's representative within five (5) working days of the date required to obtain an inspection of work which is to be concealed. The Contractor shall obtain from the Engineer written confirmation of inspection of all work to be concealed. If the

Contractor fails in his duty to notify the Owner's Representative in a timely manner and work is concealed, he must uncover all concealed areas for inspection at no cost to the Owner.

3.14 ACCESS DOORS

A. Furnish and install access doors at each point required to provide access to concealed valves, cleanouts and other devices requiring operation, adjustment or maintenance. Access doors shall have min. 12 x 12, 16 gauge steel, prime coat finish, with mounting straps, concealed hinges and screwdriver locks, designed for the doors to open 180 degrees.

B. Access doors installed in fire walls or partitions shall be UL labeled to maintain the fire rating of the wall or partition.

3.15 FLAME SPREAD AND SMOKE DEVELOPED PROPERTIES OF MATERIALS

A. Materials and adhesives used throughout the mechanical and electrical systems for insulation, and jackets or coverings of any kind, or for piping or conduit system components, shall have a flame spread rating not over 25 without evidence of continued combustion and with a smoke developed rating not higher than 50. If such materials are to be applied with adhesives, they shall be tested as applied with such adhesives, or the adhesives used shall have a flame spread rating not over 25 and a smoke developed rating not higher than 50.

B. "Flame-Spread Rating" and "Smoke Developed Rating" shall be as determined by the "Method of Test of Surface Burning Characteristics of Building Materials", NFPA No. 255, ASTM E84, Underwriter's Laboratories, Inc., Standard". Such materials are listed in the Underwriters' Laboratories, Inc. "Building Materials List" under the heading "Hazard Classification (Fire)".

3.16 HAZARDOUS MATERIALS

A. No products shall be used that contain any known hazardous or carcinogenic materials. Products with asbestos or radioactive content shall not be used.

B. Handling of any hazardous material is not covered in this specification division (15). Any requirements for such are beyond the scope of this contract and shall be done only by those persons contracted to do so.

3.17 TESTING PIPE AND DUCT SYSTEMS

A. General. Concealed piping and duct work and insulated piping and ductwork shall be tested in place before concealing or covering. Test shall be conducted in the presence of the Architect or his designated representative. Piping and ductwork located underground shall be tested before backfilling. Equipment, materials and instruments for testing shall be furnished by the Contractor without additional cost to the Owner.

B. Submittals
   1. The proposed testing procedures, including test medium and pressure, line segments and equipment included in the test, methods of isolating the test from rest of the system, and pressure monitoring techniques, shall be approved by the Engineer prior to commencement of the test.
   2. A detail report of pressure tests on piping and equipment shall be forwarded in duplicate to the Engineer. This report shall show date of test, lines tested, test

medium, length of time test pressure was held, pressure drop or rise, and extend of venting or re-pressurizing.

C. Preparatory Work

1. Remove from the system all pumps, traps, shock arrestors, expansion joints, instruments, control valves, safety valves, rupture discs, filters, orifice plates, etc., which might be damaged by the test, or are designated by the Engineer. Also remove all items such as orifice plates which might trap air in a system to be hydrostatically tested. Disconnect all instrument supplies.
2. Open but do not backseat all valves including bypass valves. Lines containing check valves shall have the source of test pressure on the upstream side.
3. Clean system prior to testing. Provide vents and drains as required.
4. Systems may be separated into sub-systems for testing if such action will expedite or simplify the testing.
5. Provide temporary supports where required to prevent over-stressing supports. When tests are completed, remove temporary supports, locks, stops, etc. and set supports for their cold load.

D. Sanitary, Waste and Vent System

1. The hydrostatic test shall be performed before installing fixtures. Water tests shall be applied to each system either in its entirety or in sections. If the test is applied to the entire system, all openings in the piping shall be closed except the highest opening, and the system shall be filled with water and tested with at least a 10 ft. head of water. In testing successive sections, at least the upper 10 ft. of the next preceding section shall be tested so that each joint or pipe in the building except the uppermost 10 ft. of the system has been submitted to a test of at least a 10 ft. head of water. The water shall be kept in the system, or in the portion under test for at least 2 hours before the inspection starts. The system shall be tight at all joints.

E. Domestic Water System

1. The hydrostatic test shall be made upon completion of the roughing-in and before setting fixtures. The entire domestic cold water and hot water, and hot water circulation piping system shall be tested at a hydrostatic pressure of 125 psig and proved tight at this pressure for a period of not less than 2 hours in order to permit inspection of all joints. Where a portion of the water piping system is to be concealed before completion, this portion shall be tested separately in a manner described for the entire system.

F. Fire Protection Systems

1. Automatic sprinkler piping shall be tested in accordance with applicable NFPA Standards and as follows. The automatic sprinkler systems shall be hydrostatically tested in their entirety or in zones defined by shut-off valves. The piping shall be tested at a pressure of 200 psig (minimum) measured at the low point in the system or zone, and shall be proved tight at this pressure for a period of not less than 2 hours. Leaks detected shall be repaired by tightening, re-welding joints or replacing pipe fittings. Caulking of joints will not be permitted.

G. Natural Gas Systems

1. All piping shall be tested pneumatically and proved tight at a pressure of 100 psi for a period of not less than 2 hours. No loss in pressure will be permitted. Leaks detected shall be repaired by tightening, re-welding joints or replacing pipe and fittings. Caulking of joints will not be permitted.

3.18 EXCAVATION, TRENCHING AND BACKFILLING

A. General: The Contractor shall perform all excavation to install piping herein specified. During excavation, material for backfilling shall be piled back from the banks of the trench to avoid overloading and to prevent slides and cave-ins. All excavated materials not to be used for back filling shall be removed and disposed of by the Contractor. Grading shall be done to prevent surface water from flowing into trenches and excavations, and any water accumulating therein shall be removed by pumping. All excavation shall be made by open cut. No tunneling shall be done. Trenches shall not be cut below a plane extending at 45 degree angle down and away from any footing.

B. Trench Excavation: The bottom of the trenches shall be graded to provide uniform bearing and support for each section of the piping on undisturbed soil at every point along its entire length, except for the portions of the pipe sections excavated for sealing of pipe joints. Depressions for joints shall be dug after the trench bottom has been graded. Over depths shall be backfilled with loose, granular, moist earth, tamped. Remove unstable soil that is not capable of supporting the pipe and replace with specified material for a minimum depth of 12" below invert of pipe.

C. Backfilling: The trenches shall be backfilled until all specified pressure tests are performed. The trenches shall be backfilled with the excavated materials approved for backfilling consisting of earth, loam, sandy clay, sand and gravel or soft shale, free from large clods of earth and stones, deposited in 6" layers and rammed until the pipe has a cover of not less than the adjacent existing ground, but not greater than 2" above existing ground. The backfilling shall be carried on simultaneously on both sides of the trench so that injurious side pressures do not occur. For all trenches, the compaction of the filled trench shall be at least equal to that of the surrounding undisturbed material, except that trenches occurring in areas to be filled shall be backfilled in 6" maximum layers and each layer compacted to 95% maximum density. Settling the backfill with water will not be permitted. Reopen any trenches not meeting compaction requirements; or where settlement occurs, refill, compact and restore the surface to the grade and compaction specified above, mounded over and smoothed off.

D. Sheeting and Shoring: Furnish, put in place and maintain sheeting and bracing required to support the sides of the excavation and prevent loss of ground which could damage or delay the work or endanger personnel or adjacent structures. All trenches shall be sloped in accordance with OSHA requirements.

END OF SECTION 15010

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. Section Includes:

1. Metal pipe hangers and supports.
2. Trapeze pipe hangers.
3. Metal framing systems.
4. Thermal-hanger shield inserts.
5. Fastener systems.
6. Pipe stands.
7. Equipment supports.

B. Related Sections:

1. Division 5 Section "Metal Fabrications" for structural-steel shapes and plates for trapeze hangers for pipe and equipment supports.
2. Division 15 Section "Vibration and Seismic Controls for HVAC Piping and Equipment" for vibration isolation devices.
3. Division 15 Section "Expansion Fittings and Loops for HVAC Piping" for pipe guides and anchors.
4. Division 15 Section(s) **"Metal Ducts"** for duct hangers and supports.

1.3 DEFINITIONS

A. MSS: Manufacturers Standardization Society of the Valve and Fittings Industry Inc.

1.4 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design trapeze pipe hangers and equipment supports, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Structural Performance: Hangers and supports for HVAC piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to **ASCE/SEI 7** Section 7-10.

1. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.

2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
3. Design seismic-restraint hangers and supports for piping and equipment and obtain approval from authorities having jurisdiction.

1.5 SUBMITTALS

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

B. Shop Drawings: Show fabrication and installation details and include calculations for the following; include Product Data for components:

1. Trapeze pipe hangers.
2. Metal framing systems.
3. Pipe stands.
4. Equipment supports.

1.6 QUALITY ASSURANCE

A. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

PART 2 - PRODUCTS

2.1 METAL PIPE HANGERS AND SUPPORTS

A. Carbon-Steel Pipe Hangers and Supports:

1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
2. Galvanized Metallic Coatings: Pre-galvanized or hot dipped.
3. Nonmetallic Coatings: Plastic coating, jacket, or liner.
4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
5. Hanger Rods: Continuous-thread rod, nuts, and washer made of **carbon steel**.

B. Stainless-Steel Pipe Hangers and Supports:

1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
2. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
3. Hanger Rods: Continuous-thread rod, nuts, and washer made of mild steel.

2.2 TRAPEZE PIPE HANGERS

A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural carbon-steel shapes with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U-bolts.

2.3 FASTENER SYSTEMS

A. Mechanical-Expansion Anchors: Insert-wedge-type, **zinc-coated** steel anchors, for use in hardened Portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

2.4 PIPE STANDS

A. General Requirements for Pipe Stands: Shop- or field-fabricated assemblies made of manufactured corrosion-resistant components to support roof-mounted piping.

B. Low-Type, Single-Pipe Stand: One-piece **stainless-steel** base unit with plastic roller, for roof installation without membrane penetration.

C. Description: Assembly of base, vertical and horizontal members, and pipe support, for roof installation without membrane penetration.
1. Base: **Stainless steel**.
2. Vertical Members: Two or more cadmium-plated-steel or stainless-steel, continuous-thread rods.
3. Horizontal Member: Cadmium-plated-steel or stainless-steel rod with plastic or stainless-steel, roller-type pipe support.

D. Curb-Mounted-Type Pipe Stands: Shop- or field-fabricated pipe supports made from structural-steel shapes, continuous-thread rods, and rollers, for mounting on permanent stationary roof curb.

2.5 EQUIPMENT SUPPORTS

A. Description: Welded, shop- or field-fabricated equipment support made from structural carbon-steel shapes.

2.6 MISCELLANEOUS MATERIALS

A. Structural Steel: ASTM A 36/A 36M, carbon-steel plates, shapes, and bars; black and galvanized.

B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, non-shrink and nonmetallic grout; suitable for interior and exterior applications.

1. Properties: Non-staining, noncorrosive, and nongaseous.
2. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT INSTALLATION

A. Metal Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.

B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.

1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.
2. Field fabricate from ASTM A 36/A 36M, carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.

C. Metal Framing System Installation: Arrange for grouping of parallel runs of piping, and support together on field-assembled metal framing systems.

D. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.

E. Fastener System Installation:

1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches (100 mm) thick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.
2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

F. Pipe Stand Installation:

1. Pipe Stand Types except Curb-Mounted Type: Assemble components and mount on smooth roof surface. Do not penetrate roof membrane.
2. Curb-Mounted-Type Pipe Stands: Assemble components or fabricate pipe stand and mount on permanent, stationary roof curb. See Division 7 Section "Roof Accessories" for curbs.

G. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.

H. Equipment Support Installation: Fabricate from welded-structural-steel shapes.

I. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

J. Install lateral bracing with pipe hangers and supports to prevent swaying.

K. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, **NPS 2-1/2 (DN 65)** and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

L. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

M. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.

N. Insulated Piping:

1. Attach clamps and spacers to piping.

    a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
    b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
    c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.

2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.

    a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 (DN 100) and larger if pipe is installed on rollers.

3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.

    a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 (DN 100) and larger if pipe is installed on rollers.

4. Shield Dimensions for Pipe: Not less than the following:

    a. NPS 1/4 to NPS 3-1/2 (DN 8 to DN 90): 12 inches (305 mm) long and 0.048 inch (1.22 mm) thick.
    b. NPS 4 (DN 100): 12 inches (305 mm) long and 0.06 inch (1.52 mm) thick.
    c. NPS 5 and NPS 6 (DN 125 and DN 150): 18 inches (457 mm) long and 0.06 inch (1.52 mm) thick.
    d. NPS 8 to NPS 14 (DN 200 to DN 350): 24 inches (610 mm) long and 0.075 inch (1.91 mm) thick.
    e. NPS 16 to NPS 24 (DN 400 to DN 600): 24 inches (610 mm) long and 0.105 inch (2.67 mm) thick.

5. Pipes NPS 8 (DN 200) and Larger: Include wood or reinforced calcium-silicate-insulation inserts of length at least as long as protective shield.
6. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.2 EQUIPMENT SUPPORTS

A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.

B. Grouting: Place grout under supports for equipment and make bearing surface smooth.

C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.3 METAL FABRICATIONS

A. Cut, drill, and fit miscellaneous metal fabrications for **trapeze pipe hangers and equipment supports**.

B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.

C. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. Finish welds at exposed connections so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

3.4 ADJUSTING

A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

B. Trim excess length of continuous-thread hanger and support rods to **1-1/2 inches (40 mm)**

3.5 PAINTING

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils (0.05 mm).

B. Touchup: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal are specified in Division 9 **painting Sections.**

C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

3.6 HANGER AND SUPPORT SCHEDULE

A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.

B. Comply with MSS SP-69 for pipe-hanger selections and applications that are not specified in piping system Sections.

C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.

D. Use carbon-steel **pipe hangers and supports metal trapeze pipe hangers and metal framing systems** and attachments for general service applications.

E. Use copper-plated pipe hangers and **copper or stainless-steel** attachments for copper piping and tubing.

F. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes NPS 3/4 to NPS 36 (DN 20 to DN 900), requiring clamp flexibility and up to 4 inches (100 mm) of insulation.
2. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes NPS 1/2 to NPS 24 (DN 15 to DN 600) if little or no insulation is required.
3. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of non-insulated, stationary pipes NPS 1/2 to NPS 8 (DN 15 to DN 200).
4. Adjustable Band Hangers (MSS Type 9): For suspension of non-insulated, stationary pipes NPS 1/2 to NPS 8 (DN 15 to DN 200).
5. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of non-insulated, stationary pipes NPS 1/2 to NPS 8 (DN 15 to DN 200).
6. Split Pipe Ring with or without Turnbuckle Hangers (MSS Type 11): For suspension of non-insulated, stationary pipes NPS 3/8 to NPS 8 (DN 10 to DN 200).
7. Extension Hinged or Two-Bolt Split Pipe Clamps (MSS Type 12): For suspension of non-insulated, stationary pipes NPS 3/8 to NPS 3 (DN 10 to DN 80).
8. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30 (DN 15 to DN 750).
9. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
10. Pipe Saddle Supports (MSS Type 36): For support of pipes NPS 4 to NPS 36 (DN 100 to DN 900), with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate.
11. Pipe Stanchion Saddles (MSS Type 37): For support of pipes NPS 4 to NPS 36 (DN 100 to DN 900), with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate, and with U-bolt to retain pipe.
12. Adjustable Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes NPS 2-1/2 to NPS 36 (DN 65 to DN 900) if vertical adjustment is required, with steel-pipe base stanchion support and cast-iron floor flange.

G. system Sections, install the following types:

1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches (150 mm) for heavy loads.

2. Steel Clevises (MSS Type 14): For 120 to 450 deg F (49 to 232 deg C) piping installations.
3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
5. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F (49 to 232 deg C) piping installations.

H. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction, to attach to top flange of structural shape.
3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
6. C-Clamps (MSS Type 23): For structural shapes.
7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
9. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
11. Malleable-Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
12. Welded-Steel Brackets: For support of pipes from below or for suspending from above by using clip and rod. Use one of the following for indicated loads:

    a. Light (MSS Type 31): 750 lb (340 kg).
    b. Medium (MSS Type 32): 1500 lb (680 kg).
    c. Heavy (MSS Type 33): 3000 lb (1360 kg).

13. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
14. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
15. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.

I. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.
    a. .

J. Comply with MSS SP-69 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.

K. Comply with MFMA-103 for metal framing system selections and applications that are not specified in piping system Sections.

L. Use **powder-actuated fasteners or mechanical-expansion anchors** instead of building attachments where required in concrete construction.

END OF SECTION 15062

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. Section Includes:

1. Equipment labels.
2. Warning signs and labels.
3. Pipe labels.
4. Duct labels.
5. Stencils.
6. Valve tags.
7. Warning tags.

1.3 SUBMITTALS

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

B. Samples: For color, letter style, and graphic representation required for each identification material and device.

C. Equipment Label Schedule: Include a listing of all equipment to be labeled with the proposed content for each label.

D. Valve numbering scheme.

E. Valve Schedules: For each piping system to include in maintenance manuals.

1.4 COORDINATION

A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

B. Coordinate installation of identifying devices with locations of access panels and doors.

C. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

A. Metal Labels for Equipment:

1. Material and Thickness: **Brass, 0.032-inch (0.8-mm) Stainless steel, 0.025-inch (0.64-mm) Aluminum, 0.032-inch (0.8-mm)or anodized aluminum, 0.032-inch (0.8-mm)** minimum thickness, and having predrilled or stamped holes for attachment hardware.
2. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch (64 by 19 mm).
3. Minimum Letter Size: 1/4 inch (6.4 mm) for name of units if viewing distance is less than 24 inches (600 mm), 1/2 inch (13 mm) for viewing distances up to 72 inches (1830 mm), and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
4. Fasteners: Stainless-steel **rivets or self-tapping screws**.
5. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Plastic Labels for Equipment:

1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, **1/8 inch (3.2 mm)** thick, and having predrilled holes for attachment hardware.
2. Letter Color: **White**.
3. Background Color: **Black**.
4. Maximum Temperature: Able to withstand temperatures up to 160 deg F (71 deg C).
5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch (64 by 19 mm).
6. Minimum Letter Size: 1/4 inch (6.4 mm) for name of units if viewing distance is less than 24 inches (600 mm), 1/2 inch (13 mm) for viewing distances up to 72 inches (1830 mm), and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
7. Fasteners: Stainless-steel **rivets or self-tapping screws**.
8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

C. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified.

D. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch (A4) bond paper. Tabulate equipment identification number and identify Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2.2 WARNING SIGNS AND LABELS

A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, **1/8 inch (3.2 mm)**thick, and having predrilled holes for attachment hardware.

B. Letter Color: **White**.

C. Background Color: **Black**.

D. Maximum Temperature: Able to withstand temperatures up to 160 deg F (71 deg C).

E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch (64 by 19 mm).

F. Minimum Letter Size: 1/4 inch (6.4 mm) for name of units if viewing distance is less than 24 inches (600 mm), 1/2 inch (13 mm) for viewing distances up to 72 inches (1830 mm), and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

G. Fasteners: Stainless-steel **rivets or self-tapping screws**.

H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

I. Label Content: Include caution and warning information, plus emergency notification instructions.

2.3 PIPE LABELS

A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.

B. Pre-tensioned Pipe Labels: Pre-coiled, semi-rigid plastic formed to **cover full** circumference of pipe and to attach to pipe without fasteners or adhesive.

C. Self-Adhesive Pipe Labels: Shall not be used.

D. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings, pipe size, and an arrow indicating flow direction.

1. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions, or as separate unit on each pipe label to indicate flow direction.
2. Lettering Size: At least 1-1/2 inches (38 mm) high.

2.4 DUCT LABELS

A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, **1/16 inch (1.6 mm)** thick, and having predrilled holes for attachment hardware.

B. Letter Color: **White**.

C. Background Color: **Black** .

D. Maximum Temperature: Able to withstand temperatures up to 160 deg F (71 deg C).

E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch (64 by 19 mm).

F. Minimum Letter Size: 1/4 inch (6.4 mm) for name of units if viewing distance is less than 24 inches (600 mm), 1/2 inch (13 mm) for viewing distances up to 72 inches (1830 mm), and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

G. Fasteners: Stainless-steel [**rivets**] [**rivets or self-tapping screws**] [**self-tapping screws**].

H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

I. Duct Label Contents: Include identification of duct service using same designations or abbreviations as used on Drawings, duct size, and an arrow indicating flow direction.

1. Flow-Direction Arrows: Integral with duct system service lettering to accommodate both directions, or as separate unit on each duct label to indicate flow direction.
2. Lettering Size: At least 1-1/2 inches (38 mm) high.

2.5 STENCILS

A. Stencils: Prepared with letter sizes according to ASME A13.1 for piping; minimum letter height of 1-1/4 inches (32 mm) for ducts; and minimum letter height of 3/4 inch (19 mm) for access panel and door labels, equipment labels, and similar operational instructions.

1. Stencil Material: **Fiberboard or metal**.
2. Stencil Paint: Exterior, gloss, **alkyd enamel** black unless otherwise indicated. Paint may be in pressurized spray-can form.
3. Identification Paint: Exterior, **alkyd enamel** in colors according to ASME A13.1 unless otherwise indicated.

2.6 VALVE TAGS

A. Valve Tags: Stamped or engraved with 1/4-inch (6.4-mm) letters for piping system abbreviation and 1/2-inch (13-mm) numbers.

1. Tag Material: **Brass, 0.032-inch (0.8-mm) anodized aluminum, 0.032-inch (0.8-mm)**] minimum thickness, and having predrilled or stamped holes for attachment hardware.
2. Fasteners: Brass **wire-link or beaded chain; or S-hook**.

3. Valve-tag schedule shall be included in operation and maintenance data.

2.7 WARNING TAGS

A. Warning Tags: Preprinted or partially preprinted, accident-prevention tags, of plasticized card stock with matte finish suitable for writing.

1. Size: **Approximately 4 by 7 inches (100 by 178 mm)**]
2. Fasteners: **Brass grommet and wire**.
3. Nomenclature: Large-size primary caption such as "DANGER," "CAUTION," or "DO NOT OPERATE."
4. Color: Yellow background with black lettering.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulating materials.

3.2 EQUIPMENT LABEL INSTALLATION

A. Install or permanently fasten labels on each major item of mechanical equipment.

B. Locate equipment labels where accessible and visible.

3.3 PIPE LABEL INSTALLATION

A. Piping Color-Coding: Painting of piping is specified in Division 9 Section "**Interior Painting**."

B. Stenciled Pipe Label Option: Stenciled labels may be provided instead of manufactured pipe labels, at Installer's option. Install stenciled pipe labels **with painted, color-coded bands or rectangles, complying with ASME A13.1,** on each piping system.

1. Identification Paint: Use for contrasting background.
2. Stencil Paint: Use for pipe marking.

C. Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:

1. Near each valve and control device.
2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
4. At access doors, manholes, and similar access points that permit view of concealed piping.
5. Near major equipment items and other points of origination and termination.
6. Spaced at maximum intervals of 25 **feet (7.5 m)** along each run. Reduce intervals to **10 feet (3.0 m)**] in areas of congested piping and equipment.
7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.

D. Pipe Label Color Schedule:

a. >.

2. Refrigerant Piping:

a. Background Color: **White**.
b. Letter Color: **Red**.

3.4 DUCT LABEL INSTALLATION

A. Install **self-adhesive** duct labels with permanent adhesive on air ducts in the following color codes:

1. **Blue** For cold-air supply ducts.
2. **Yellow** : For hot-air supply ducts.
3. **Green** For exhaust-, outside-, relief-, return-, and mixed-air ducts.
4. ASME A13.1 Colors and Designs: For hazardous material exhaust.

B. Stenciled Duct Label Option: Stenciled labels, showing service and flow direction, may be provided instead of plastic-laminated duct labels, at Installer's option, if lettering larger than 1 inch (25 mm) high is needed for proper identification because of distance from normal location of required identification.

C. Locate labels near points where ducts enter into concealed spaces and at maximum intervals of **25 feet (7.5 m)**] in each space where ducts are exposed or concealed by removable ceiling system.

3.5 VALVE-TAG INSTALLATION

A. Install tags on valves and control devices in piping systems, except check valves; valves within factory-fabricated equipment units; shutoff valves; faucets; convenience and lawn-watering hose connections; and HVAC terminal devices and similar roughing-in connections of end-use fixtures and units. List tagged valves in a valve schedule.

B. Valve-Tag Application Schedule: Tag valves according to size, shape, and color scheme and with captions similar to those indicated in the following subparagraphs:

1. Valve-Tag Size and Shape:
   a. Refrigerant: **1-1/2 inches (38 mm)square**
   b. Hot Water: **1-1/2 inches (38 mm) square** .
   c. Gas: **1-1/2 inches (38 mm)**.

2. Valve-Tag Color:
   a. Refrigerant: **Green** .
   b. Hot Water: **Natural**.
   c. Gas: **Yellow**.

3. Letter Color:
   a. Refrigerant: **White** .
   b. Hot Water: **Black**.
   c. Gas: [**Black** .

3.6 WARNING-TAG INSTALLATION

A. Write required message on, and attach warning tags to, equipment and other items where required.

END OF SECTION 15077

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. Section Includes:

1. Insulation Materials:

    a. Calcium silicate.
    b. Cellular glass.
    c. Flexible elastomeric.
    d. Mineral fiber.
    e. Phenolic.
    f. Polyisocyanurate.
    g. Polyolefin.
    h. Polystyrene.

2. Fire-rated insulation systems.
3. Insulating cements.
4. Adhesives.
5. Mastics.
6. Lagging adhesives.
7. Sealants.
8. Factory-applied jackets.
9. Field-applied fabric-reinforcing mesh.
10. Field-applied cloths.
11. Field-applied jackets.
12. Tapes.
13. Securements.
14. Corner angles.

B. Related Sections:

1. Division 2 Section "Hydronic Distribution" for loose-fill pipe insulation in underground piping outside the building.
2. Division 2 Section "Steam Distribution" for loose-fill pipe insulation in underground piping outside the building.
3. Division 15 Section "Fire-Suppression Systems Insulation."
4. Division 15 Section "Plumbing Insulation."
5. Division 15 Section "Metal Ducts" for duct liners.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include thermal conductivity, thickness, and jackets (both factory and field applied, if any).

B. Adhesives Submittal:

1. Product Data for Credit EQ 4.1: For adhesives and sealants, including printed statement of VOC content.

C. Shop Drawings:

1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
2. Detail attachment and covering of heat tracing inside insulation.
3. Detail insulation application at pipe expansion joints for each type of insulation.
4. Detail insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
5. Detail removable insulation at piping specialties, equipment connections, and access panels.
6. Detail application of field-applied jackets.
7. Detail application at linkages of control devices.
8. Detail field application for each equipment type.

D. Qualification Data: For qualified Installer.

E. Material Test Reports: Factory test reports.

F. Field quality-control reports.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.

B. Fire-Test-Response Characteristics: Insulation and related materials shall have fire-test-response characteristics indicated, as determined by testing identical products per ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing and inspecting agency.

1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.6 COORDINATION

A. Coordinate size and location of supports, hangers, and insulation shields specified in Division 15 Section "Hangers and Supports."

B. Coordinate clearance requirements with piping Installer for piping insulation application, duct Installer for duct insulation application, and equipment Installer for equipment insulation application. Before preparing piping and ductwork Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

C. Coordinate installation and testing of heat tracing.

1.7 SCHEDULING

A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.

B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

A. Products shall not contain asbestos, lead, mercury, or mercury compounds.

B. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.

C. Flexible Elastomeric: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials and Type II for sheet materials.

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

a. Aeroflex USA Inc.; Aerocel.
b. Armacell LLC; AP Armaflex.
c. RBX Corporation; Insul-Sheet 1800 and Insul-Tube 180.

D. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II and ASTM C 1290, Type **I**. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

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

a. CertainTeed Corp.; Duct Wrap.
b. Johns Manville; Microlite.

c. Knauf Insulation; Duct Wrap.
d. Manson Insulation Inc.; Alley Wrap.
e. Owens Corning; All-Service Duct Wrap.

E. High-Temperature, Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type V, without factory-applied jacket.

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

a. Johns Manville; HTB 23 Spin-Glass.
b. Owens Corning; High Temperature Flexible Batt Insulations.

2.

F. Phenolic:

G. Polyolefin: Unicellular, polyethylene thermal plastic insulation. Comply with ASTM C 534 or ASTM C 1427, Type I, Grade 1 for tubular materials and Type II, Grade 1 for sheet materials.

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

a. Armacell LLC; Tubolit.
b. Nomaco Inc.; IMCOLOCK, IMCOSHEET, NOMALOCK, and NOMAPLY.
c. RBX Corporation; Therma-cell.

H. Polystyrene: Rigid, extruded cellular polystyrene intended for use as thermal insulation. Comply with ASTM C 578, Type IV or Type XIII, except thermal conductivity (k-value) shall not exceed 0.26 Btu x in./h x sq. ft. x deg F (0.038 W/m x K) after 180 days of aging. Fabricate shapes according to ASTM C 450 and ASTM C 585.

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. Dow Chemical Company (The); Styrofoam.
b. Knauf Insulation; Knauf Polystyrene.
c. <**Insert manufacturer's name; product name or designation.**>

2.2 FIRE-RATED INSULATION SYSTEMS

2.3 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated.

B. Calcium Silicate Adhesive: Fibrous, sodium-silicate-based adhesive with a service temperature range of 50 to 800 deg F (10 to 427 deg C).

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

a. Childers Products, Division of ITW; CP-97.
b. Foster Products Corporation, H. B. Fuller Company; 81-27/81-93.
c. Marathon Industries, Inc.; 290.
d. Mon-Eco Industries, Inc.; 22-30.
e. Vimasco Corporation; 760.

2. For indoor applications, use adhesive that has a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

C. Flexible Elastomeric and Polyolefin Adhesive: Comply with MIL-A-24179A, Type II, Class I.

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

a. Aeroflex USA Inc.; Aeroseal.
b. Armacell LCC; 520 Adhesive.
c. Foster Products Corporation, H. B. Fuller Company; 85-75.
d. RBX Corporation; Rubatex Contact Adhesive.

2. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

D. PVC Jacket Adhesive: Compatible with PVC jacket.

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

a. Dow Chemical Company (The); 739, Dow Silicone.
b. Johns-Manville; Zeston Perma-Weld, CEEL-TITE Solvent Welding Adhesive.
c. P.I.C. Plastics, Inc.; Welding Adhesive.
d. Speedline Corporation; Speedline Vinyl Adhesive.

2. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.4 SEALANTS

A. Joint Sealants:

1. Joint Sealants for Polystyrene Products: Subject to compliance with requirements, **available products that may be incorporated into the Work include, but are not limited to, the following**:

a. Childers Products, Division of ITW; CP-70.
b. Foster Products Corporation, H. B. Fuller Company; 30-45/30-46.
c. Marathon Industries, Inc.; 405.
d. Mon-Eco Industries, Inc.; 44-05.
e. Vimasco Corporation; 750.

2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Permanently flexible, elastomeric sealant.
4. Service Temperature Range: Minus 100 to plus 300 deg F (Minus 73 to plus 149 deg C).

5. Color: White or gray.
6. For indoor applications, use sealants that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. FSK and Metal Jacket Flashing Sealants:

2.5 FIELD-APPLIED JACKETS

A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.

B. FSK Jacket: Aluminum-foil-face, fiberglass-reinforced scrim with kraft-paper backing.

2.6 TAPES

A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.

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. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0835.
   b. Compac Corp.; 104 and 105.
   c. Ideal Tape Co., Inc., an American Biltrite Company; 428 AWF ASJ.
   d. Venture Tape; 1540 CW Plus, 1542 CW Plus, and 1542 CW Plus/SQ.

2. Width: 3 inches (75 mm).
3. Thickness: 11.5 mils (0.29 mm).
4. Adhesion: 90 ounces force/inch (1.0 N/mm) in width.
5. Elongation: 2 percent.
6. Tensile Strength: 40 lbf/inch (7.2 N/mm) in width.
7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

B. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive. Suitable for indoor and outdoor applications.

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. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0555.
   b. Compac Corp.; 130.
   c. Ideal Tape Co., Inc., an American Biltrite Company; 370 White PVC tape.
   d. Venture Tape; 1506 CW NS.

2. Width: 2 inches (50 mm).
3. Thickness: 6 mils (0.15 mm).
4. Adhesion: 64 ounces force/inch (0.7 N/mm) in width.
5. Elongation: 500 percent.
6. Tensile Strength: 18 lbf/inch (3.3 N/mm) in width.

C. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.

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. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0800.
    b. Compac Corp.; 120.
    c. Ideal Tape Co., Inc., an American Biltrite Company; 488 AWF.
    d. Venture Tape; 3520 CW.

2. Width: 2 inches (50 mm).
3. Thickness: 3.7 mils (0.093 mm).
4. Adhesion: 100 ounces force/inch (1.1 N/mm) in width.
5. Elongation: 5 percent.
6. Tensile Strength: 34 lbf/inch (6.2 N/mm) in width.

2.7 SECUREMENTS

A. Bands:

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

    a. Childers Products; Bands.
    b. PABCO Metals Corporation; Bands.
    c. RPR Products, Inc.; Bands.

2. Stainless Steel: ASTM A 167 or ASTM A 240/A 240M, Type **304 or Type 316**; 0.015 inch (0.38 mm) thick, [**1/2 inch (13 mm)**] [**3/4 inch (19 mm)**] wide with **wing seal**.
3. Springs: Twin spring set constructed of stainless steel with ends flat and slotted to accept metal bands. Spring size determined by manufacturer for application.

B. Insulation Pins and Hangers:

1. Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, [**0.106-inch- (2.6-mm-)**] [**0.135-inch- (3.5-mm-)**] diameter shank, length to suit depth of insulation indicated.

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

        1) AGM Industries, Inc.; CWP-1.
        2) GEMCO; CD.
        3) Midwest Fasteners, Inc.; CD.
        4) Nelson Stud Welding; TPA, TPC, and TPS.

2. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, [**0.106-inch- (2.6-mm-)**] [**0.135-inch- (3.5-mm-)**] diameter shank, length to suit depth of insulation indicated with integral 1-1/2-inch (38-mm) galvanized carbon-steel washer.

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

1) AGM Industries, Inc.; CWP-1.
2) GEMCO; Cupped Head Weld Pin.
3) Midwest Fasteners, Inc.; Cupped Head.
4) Nelson Stud Welding; CHP.

C. Staples: Outward-clinching insulation staples, nominal 3/4-inch- (19-mm-) wide, stainless steel or Monel.

D. Wire: [**0.080-inch (2.0-mm) nickel-copper alloy 0.062-inch (1.6-mm) soft-annealed, stainless steel 0.062-inch (1.6-mm) soft-annealed, galvanized steel**.

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. C & F Wire.
b. Childers Products.
c. PABCO Metals Corporation.
d. RPR Products, Inc.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation and other conditions affecting performance of insulation application.

1. Verify that systems and equipment to be insulated have been tested and are free of defects.
2. Verify that surfaces to be insulated are clean and dry.
3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

B. Surface Preparation: Clean and prepare surfaces to be insulated. Before insulating, apply a corrosion coating to insulated surfaces as follows:

1. Stainless Steel: Coat 300 series stainless steel with an epoxy primer 5 mils (0.127 mm) thick and an epoxy finish 5 mils (0.127 mm) thick if operating in a temperature range between 140 and 300 deg F (60 and 149 deg C). Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.
2. Carbon Steel: Coat carbon steel operating at a service temperature between 32 and 300 deg F (0 and 149 deg C) with an epoxy coating. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.

C. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.

D. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

3.3 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of equipment, ducts and fittings, and piping including fittings, valves, and specialties.

B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of equipment, duct system, and pipe system as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.

G. Keep insulation materials dry during application and finishing.

H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

I. Install insulation with least number of joints practical.

J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.

1. Install insulation continuously through hangers and around anchor attachments.
2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.

K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

L. Install insulation with factory-applied jackets as follows:

1. Draw jacket tight and smooth.
2. Cover circumferential joints with 3-inch- (75-mm-) wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches (100 mm) o.c.

3. Overlap jacket longitudinal seams at least 1-1/2 inches (38 mm). Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at **2 inches (50 mm)** o.c.

   a. For below ambient services, apply vapor-barrier mastic over staples.

4. Cover joints and seams with tape as recommended by insulation material manufacturer to maintain vapor seal.
5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to duct and pipe flanges and fittings.

M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches (100 mm) beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

P. For above ambient services, do not install insulation to the following:

1. Vibration-control devices.
2. Testing agency labels and stamps.
3. Nameplates and data plates.
4. Manholes.
5. Hand holes.
6. Cleanouts.

3.4 PENETRATIONS

A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches (50 mm) below top of roof flashing.
4. Seal jacket to roof flashing with flashing sealant.

B. Insulation Installation at Underground Exterior Wall Penetrations: Terminate insulation flush with sleeve seal. Seal terminations with flashing sealant.

C. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.

1. Seal penetrations with flashing sealant.

2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches (50 mm).
4. Seal jacket to wall flashing with flashing sealant.

D. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

E. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions. Terminate insulation at fire damper sleeves for fire-rated wall and partition penetrations. Externally insulate damper sleeves to match adjacent insulation and overlap duct insulation at least 2 inches (50 mm).

1. Comply with requirements in Division 7 Section "Through-Penetration Firestop Systems" for fire stopping and fire-resistive joint sealers.

F. Insulation Installation at Floor Penetrations:

1. Duct: Install insulation continuously through floor penetrations that are not fire rated. For penetrations through fire-rated assemblies, terminate insulation at fire damper sleeves and externally insulate damper sleeve beyond floor to match adjacent duct insulation. Overlap damper sleeve and duct insulation at least 2 inches (50 mm).
2. Pipe: Install insulation continuously through floor penetrations.
3. Seal penetrations through fire-rated assemblies. Comply with requirements in Division 7 Section "Through-Penetration Firestop Systems."

3.5 FLEXIBLE ELASTOMERIC INSULATION INSTALLATION

A. Seal longitudinal seams and end joints with manufacturers recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

B. Insulation Installation on Pipe Flanges:

1. Install pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as pipe insulation.
4. Secure insulation to flanges and seal seams with manufacturers recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install mitered sections of pipe insulation.
2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed valve covers manufactured of same material as pipe insulation when available.
2. When preformed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.
4. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

5.
6. Install insulation to flanges as specified for flange insulation application.

3.6 FINISHES

A. Duct, Equipment, and Pipe Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Division 9 painting Sections.

1. Flat Acrylic Finish: **Two** finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.

a. Finish Coat Material: Interior, flat, latex-emulsion size.

B. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.

C. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.

D. Do not field paint aluminum or stainless-steel jackets.

3.7 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:

1. Inspect ductwork, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to **one** location(s) for each duct system defined in the "Duct Insulation Schedule, General" Article.
2.

C. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.8 DUCT INSULATION SCHEDULE, GENERAL

A. Plenums and Ducts Requiring Insulation:

1. Indoor, concealed supply and outdoor air.
2. Indoor, exposed supply and outdoor air.
3. Indoor, concealed return located in non-conditioned space.
4. Indoor, exposed return located in non-conditioned space.
5. Indoor, concealed, Type I, commercial, kitchen hood exhaust.
6. Indoor, concealed exhaust between isolation damper and penetration of building exterior.
7. Indoor, exposed exhaust between isolation damper and penetration of building exterior.
8. Outdoor, concealed supply and return.
9. Outdoor, exposed supply and return.

B. Items Not Insulated:

1. Fibrous-glass ducts.
2. Metal ducts with duct liner of sufficient thickness to comply with energy code and ASHRAE/IESNA 90.1.
3. Factory-insulated flexible ducts.
4. Factory-insulated plenums and casings.
5. Flexible connectors.
6. Vibration-control devices.
7. Factory-insulated access panels and doors.

3.9 INDOOR DUCT AND PLENUM INSULATION SCHEDULE

1.

B. Concealed, rectangular, supply-air duct insulation shall be **one of** the following:
1. Mineral-Fiber Blanket: **1-1/2 inches (38 mm)** thick and **0.75-lb/cu. ft. (12-kg/cu. m)** nominal density.

C. Concealed, rectangular, return-air duct insulation shall be **one of** the following:
1. Mineral-Fiber Blanket: **1-1/2 inches (38 mm)** thick and **0.75-lb/cu. ft. (12-kg/cu. m)** nominal density.

D. Concealed, rectangular, outdoor-air duct insulation shall be **one of** the following:
1. Mineral-Fiber Blanket: **1-1/2 inches (38 mm** thick and **0.75-lb/cu. ft. (12-kg/cu. m** nominal density.

E. Concealed, rectangular, exhaust-air duct insulation between isolation damper and penetration of building exterior shall be **one of** the following:
1. Mineral-Fiber Blanket: **1-1/2 inches (38 mm** thick and **0.75-lb/cu. ft. (12-kg/cu. m** nominal density.

END OF SECTION 15083

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. Section Includes:

1. Bronze angle valves.
2. Brass ball valves.
3. Bronze ball valves.
4. Bronze lift check valves.
5. Bronze swing check valves.
6. Bronze gate valves.
7. Bronze globe valves.
8. Lubricated plug valves.
9. Eccentric plug valves.

B. Related Sections:

1. Division 15 HVAC piping Sections for specialty valves applicable to those Sections only.
2. Division 15 Section "Identification for HVAC Piping and Equipment" for valve tags and schedules.

1.3 DEFINITIONS

A. CWP: Cold working pressure.

B. EPDM: Ethylene propylene copolymer rubber.

C. NBR: Acrylonitrile-butadiene, Buna-N, or nitrile rubber.

D. NRS: Non rising stem.

E. OS&Y: Outside screw and yoke.

F. RS: Rising stem.

G. SWP: Steam working pressure.

1.4 SUBMITTALS

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

1.5 QUALITY ASSURANCE

A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.

B. ASME Compliance:

1. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
2. ASME B31.1 for power piping valves.
3. ASME B31.9 for building services piping valves.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Prepare valves for shipping as follows:

1. Protect internal parts against rust and corrosion.
2. Protect threads, flange faces, grooves, and weld ends.
3. Set angle, gate, and globe valves closed to prevent rattling.
4. Set ball and plug valves open to minimize exposure of functional surfaces.
5. Set butterfly valves closed or slightly open.
6. Block check valves in either closed or open position.

B. Use the following precautions during storage:

1. Maintain valve end protection.
2. Store valves indoors and maintain at higher than ambient dew point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.

C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use hand wheels or stems as lifting or rigging points.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR VALVES

A. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures by the equipment manufacturer.

B. Valve Sizes: Same as upstream piping unless otherwise indicated.

C. Valve Actuator Types:
1. Hand lever: For quarter-turn valves NPS 6 (DN 150) and smaller **except plug valves**.
2. Wrench: For plug valves with square heads. Furnish Owner with 1 wrench for every **5** plug valves, for each size square plug-valve head.

D. Valve-End Connections:

1. Flanged: With flanges according to ASME B16.1 for iron valves.
2. Grooved: With grooves according to AWWA C606.
3. Solder Joint: With sockets according to ASME B16.18.

4. Threaded: With threads according to ASME B1.20.1.

E. Valve Bypass and Drain Connections: MSS SP-45.

2.2 BRONZE ANGLE VALVES

A. Class 125, Bronze Angle Valves with Bronze Disc:

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. Hammond Valve.
   b. Milwaukee Valve Company.

2. Description:

   a. Standard: MSS SP-80, Type 1.
   b. CWP Rating: 200 psig (1380 kPa).
   c. Body Material: ASTM B 62, bronze with integral seat and screw-in bonnet.
   d. Ends: Threaded.
   e. Stem and Disc: Bronze.
   f. Packing: Asbestos free.
   g. Hand wheel: Malleable iron.

B. Class 125, Bronze Angle Valves with Nonmetallic Disc:

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

   a. American Valve, Inc.
   b. NIBCO INC.
   c. Crane Co >.

2. Description:

   a. Standard: MSS SP-80, Type 2.
   b. CWP Rating: 200 psig (1380 kPa).
   c. Body Material: ASTM B 62, bronze with integral seat and screw-in bonnet.
   d. Ends: Threaded.
   e. Stem: Bronze.
   f. Disc: PTFE or TFE.
   g. Packing: Asbestos free.
   h. Handwheel: Malleable iron.

C. Class 150, Bronze Angle Valves with Bronze Disc:

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**:

D.

a. Crane Co.; Crane Valve Group; Stockham Division.
b. Kitz Corporation.

2. Description:

a. Standard: MSS SP-80, Type 1.
b. CWP Rating: 300 psig (2070 kPa).
c. Body Material: ASTM B 62, bronze with integral seat and union-ring bonnet.
d. Ends: Threaded.
e. Stem and Disc: Bronze.
f. Packing: Asbestos free.
g. Handwheel: Malleable iron .

E. Class 150, Bronze Angle Valves with Nonmetallic Disc:

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

a. Crane Co.; Crane Valve Group; Crane Valves.
b. Crane Co.; Crane Valve Group; Jenkins Valves.
c. Crane Co.; Crane Valve Group; Stockham Division.
d. Hammond Valve.
e. Milwaukee Valve Company.
f. NIBCO INC.
g. Powell Valves.

2. Description:

a. Standard: MSS SP-80, Type 2.
b. CWP Rating: 300 psig (2070 kPa).
c. Body Material: ASTM B 62, bronze with integral seat and union-ring bonnet.
d. Ends: Threaded.
e. Stem: Bronze.
f. Disc: PTFE or TFE.
g. Packing: Asbestos free.
h. Handwheel: Malleable iron.

2.3 BRASS BALL VALVES

A. One-Piece, Reduced-Port, Brass Ball Valves with Brass Trim:

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

a. Kitz Corporation.
b. <**Insert manufacturer's name**>.

2. Description:

a. Standard: MSS SP-110.
b. CWP Rating: 400 psig (2760 kPa).
c. Body Design: One piece.

d. Body Material: Forged brass.
e. Ends: Threaded.
f. Seats: PTFE or TFE.
g. Stem: Brass.
h. Ball: Chrome-plated brass.
i. Port: Reduced.

B. Two-Piece, Full-Port, Brass Ball Valves with Brass Trim:

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

a. Crane Co.; Crane Valve Group; Crane Valves.
b. Crane Co.; Crane Valve Group; Jenkins Valves.
c. DynaQuip Controls.
d. Flow-Tek, Inc.; a subsidiary of Bray International, Inc.
e. Hammond Valve.
f. Jamesbury; a subsidiary of Metso Automation.
g. Jomar International, LTD.
h. Kitz Corporation.
i. Legend Valve.
j. Marwin Valve; a division of Richards Industries.
k. Milwaukee Valve Company.
l. NIBCO INC.
m. Red-White Valve Corporation.
n. RuB Inc.

2. Description:

a. Standard: MSS SP-110.
b. SWP Rating: 150 psig (1035 kPa).
c. CWP Rating: 600 psig (4140 kPa).
d. Body Design: Two piece.
e. Body Material: Forged brass.
f. Ends: Threaded.
g. Seats: PTFE or TFE.
h. Stem: Brass.
i. Ball: Chrome-plated brass.
j. Port: Full.

C. Two-Piece, Full-Port, Brass Ball Valves with Stainless-Steel Trim:

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

a. Crane Co.; Crane Valve Group; Crane Valves.
b. Crane Co.; Crane Valve Group; Jenkins Valves.
c. Flow-Tek, Inc.; a subsidiary of Bray International, Inc.
d. Hammond Valve.
e. Jamesbury; a subsidiary of Metso Automation.
f. Kitz Corporation.
g. Marwin Valve; a division of Richards Industries.
h. Milwaukee Valve Company.
i. RuB Inc.

2. Description:

a. Standard: MSS SP-110.
b. SWP Rating: 150 psig (1035 kPa).
c. CWP Rating: 600 psig (4140 kPa).
d. Body Design: Two piece.
e. Body Material: Forged brass.
f. Ends: Threaded.
g. Seats: PTFE or TFE.
h. Stem: Stainless steel.
i. Ball: Stainless steel, vented.
j. Port: Full.

D. Two-Piece, Regular-Port, Brass Ball Valves with Brass Trim:

1. Manufacturers: Subject to compliance with requirements, **available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following**:

a. Hammond Valve.
b. Jamesbury; a subsidiary of Metso Automation.
c. Legend Valve.
d. Marwin Valve; a division of Richards Industries.
e. Milwaukee Valve Company.

2. Description:

a. Standard: MSS SP-110.
b. SWP Rating: 150 psig (1035 kPa).
c. CWP Rating: 600 psig (4140 kPa).
d. Body Design: Two piece.
e. Body Material: Forged brass.
f. Ends: Threaded.
g. Seats: PTFE or TFE.
h. Stem: Brass.
i. Ball: Chrome-plated brass.
j. Port: Regular.

E. Two-Piece, Regular-Port, Brass Ball Valves with Stainless-Steel Trim:

1. Manufacturers: Subject to compliance with requirements, **available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following**:

a. Jamesbury; a subsidiary of Metso Automation.
b. Marwin Valve; a division of Richards Industries.

2. Description:

a. Standard: MSS SP-110.
b. SWP Rating: 150 psig (1035 kPa).
c. CWP Rating: 600 psig (4140 kPa).
d. Body Design: Two piece.

e. Body Material: Brass or bronze.
f. Ends: Threaded.
g. Seats: PTFE or TFE.
h. Stem: Stainless steel.
i. Ball: Stainless steel, vented.
j. Port: Regular.

F. Three-Piece, Full-Port, Brass Ball Valves with Brass Trim:

1. Manufacturers: Subject to compliance with requirements, **available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following**:

a. Jomar International, LTD.
b. Kitz Corporation.
c. Red-White Valve Corporation.
d. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
e. <**Insert manufacturer's name**>.

2. Description:

a. Standard: MSS SP-110.
b. SWP Rating: 150 psig (1035 kPa).
c. CWP Rating: 600 psig (4140 kPa).
d. Body Design: Three piece.
e. Body Material: Forged brass.
f. Ends: Threaded.
g. Seats: PTFE or TFE.
h. Stem: Brass.
i. Ball: Chrome-plated brass.
j. Port: Full.

G. Three-Piece, Full-Port, Brass Ball Valves with Stainless-Steel Trim:

1. Manufacturers: Subject to compliance with requirements, **available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following**:

a. Jomar International, LTD.
b. Kitz Corporation.
c. Marwin Valve; a division of Richards Industries.
d. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
e. <**Insert manufacturer's name**>.

2. Description:

a. Standard: MSS SP-110.
b. SWP Rating: 150 psig (1035 kPa).
c. CWP Rating: 600 psig (4140 kPa).
d. Body Design: Three piece.
e. Body Material: Forged brass.
f. Ends: Threaded.
g. Seats: PTFE or TFE.

h. Stem: Stainless steel.
i. Ball: Stainless steel, vented.
j. Port: Full.

2.4 BRONZE BALL VALVES

A. One-Piece, Reduced-Port, Bronze Ball Valves with Bronze Trim:

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

a. American Valve, Inc.
b. Conbraco Industries, Inc.; Apollo Valves.
c. NIBCO INC.

2. Description:

a. Standard: MSS SP-110.
b. CWP Rating: 400 psig (2760 kPa).
c. Body Design: One piece.
d. Body Material: Bronze.
e. Ends: Threaded.
f. Seats: PTFE or TFE.
g. Stem: Bronze.
h. Ball: Chrome-plated brass.
i. Port: Reduced.

B. One-Piece, Reduced-Port, Bronze Ball Valves with Stainless-Steel Trim:

1. Manufacturers: Subject to compliance with requirements, **manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following**:

a. Conbraco Industries, Inc.; Apollo Valves.
b. NIBCO INC.

2. Description:

a. Standard: MSS SP-110.
b. CWP Rating: 600 psig (4140 kPa).
c. Body Design: One piece.
d. Body Material: Bronze.
e. Ends: Threaded.
f. Seats: PTFE or TFE.
g. Stem: Stainless steel.
h. Ball: Stainless steel, vented.
i. Port: Reduced.

C. Two-Piece, Full-Port, Bronze Ball Valves with Bronze Trim:

1. Manufacturers: Subject to compliance with requirements, **available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following**:

    a. American Valve, Inc.
    b. Conbraco Industries, Inc.; Apollo Valves.
    c. Crane Co.; Crane Valve Group; Crane Valves.
    d. Hammond Valve.
    e. Lance Valves; a division of Advanced Thermal Systems, Inc.
    f. Legend Valve.
    g. Milwaukee Valve Company.
    h. NIBCO INC.
    i. Red-White Valve Corporation.
    j. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

    a. Standard: MSS SP-110.
    b. SWP Rating: 150 psig (1035 kPa).
    c. CWP Rating: 600 psig (4140 kPa).
    d. Body Design: Two piece.
    e. Body Material: Bronze.
    f. Ends: Threaded.
    g. Seats: PTFE or TFE.
    h. Stem: Bronze.
    i. Ball: Chrome-plated brass.
    j. Port: Full.

D. Two-Piece, Full-Port, Bronze Ball Valves with Stainless-Steel Trim:

1. Manufacturers: Subject to compliance with requirements, **available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following**:

    a. Conbraco Industries, Inc.; Apollo Valves.
    b. Crane Co.; Crane Valve Group; Crane Valves.
    c. Hammond Valve.
    d. Lance Valves; a division of Advanced Thermal Systems, Inc.
    e. Milwaukee Valve Company.
    f. NIBCO INC.
    g. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

    a. Standard: MSS SP-110.
    b. SWP Rating: 150 psig (1035 kPa).
    c. CWP Rating: 600 psig (4140 kPa).
    d. Body Design: Two piece.
    e. Body Material: Bronze.
    f. Ends: Threaded.
    g. Seats: PTFE or TFE.
    h. Stem: Stainless steel.
    i. Ball: Stainless steel, vented.
    j. Port: Full.

E. Two-Piece, Regular-Port, Bronze Ball Valves with Bronze Trim:

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

a. American Valve, Inc.
b. Conbraco Industries, Inc.; Apollo Valves.
c. Crane Co.; Crane Valve Group; Jenkins Valves.
d. Crane Co.; Crane Valve Group; Stockham Division.
e. DynaQuip Controls.
f. Hammond Valve.
g. Lance Valves; a division of Advanced Thermal Systems, Inc.
h. Milwaukee Valve Company.
i. NIBCO INC.

2. Description:

a. Standard: MSS SP-110.
b. SWP Rating: 150 psig (1035 kPa).
c. CWP Rating: 600 psig (4140 kPa).
d. Body Design: Two piece.
e. Body Material: Bronze.
f. Ends: Threaded.
g. Seats: PTFE or TFE.
h. Stem: Bronze.
i. Ball: Chrome-plated brass.
j. Port: Regular.

F. Two-Piece, Regular-Port, Bronze Ball Valves with Stainless-Steel Trim:

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

a. Conbraco Industries, Inc.; Apollo Valves.
b. Crane Co.; Crane Valve Group; Jenkins Valves.
c. Hammond Valve.
d. Milwaukee Valve Company.

2. Description:

a. Standard: MSS SP-110.
b. SWP Rating: 150 psig (1035 kPa).
c. CWP Rating: 600 psig (4140 kPa).
d. Body Design: Two piece.
e. Body Material: Bronze.
f. Ends: Threaded.
g. Seats: PTFE or TFE.
h. Stem: Stainless steel.
i. Ball: Stainless steel, vented.
j. Port: Regular.

G. Three-Piece, Full-Port, Bronze Ball Valves with Bronze Trim:

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

    a. Conbraco Industries, Inc.; Apollo Valves.
    b. DynaQuip Controls.
    c. Hammond Valve.
    d. Milwaukee Valve Company.
    e. NIBCO INC.
    f. Red-White Valve Corporation.

2. Description:

    a. Standard: MSS SP-110.
    b. SWP Rating: 150 psig (1035 kPa).
    c. CWP Rating: 600 psig (4140 kPa).
    d. Body Design: Three piece.
    e. Body Material: Bronze.
    f. Ends: Threaded.
    g. Seats: PTFE or TFE.
    h. Stem: Bronze.
    i. Ball: Chrome-plated brass.
    j. Port: Full.

H. Three-Piece, Full-Port, Bronze Ball Valves with Stainless-Steel Trim:

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. Conbraco Industries, Inc.; Apollo Valves.
    b. Hammond Valve.
    c. Milwaukee Valve Company.
    d. NIBCO INC.

2. Description:

    a. Standard: MSS SP-110.
    b. SWP Rating: 150 psig (1035 kPa).
    c. CWP Rating: 600 psig (4140 kPa).
    d. Body Design: Three piece.
    e. Body Material: Bronze.
    f. Ends: Threaded.
    g. Seats: PTFE or TFE.
    h. Stem: Stainless steel.
    i. Ball: Stainless steel, vented.
    j. Port: Full.

2.5 IRON BALL VALVES

A. Class 125, Iron Ball Valves:

1. Manufacturers: Subject to compliance with requirements, **available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following**:

    a. American Valve, Inc.
    b. Conbraco Industries, Inc.; Apollo Valves.
    c. Kitz Corporation.
    d. Sure Flow Equipment Inc.
    e. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
    f. <**Insert manufacturer's name**>.

2. Description:

    a. Standard: MSS SP-72.
    b. CWP Rating: 200 psig (1380 kPa).
    c. Body Design: Split body.
    d. Body Material: ASTM A 126, gray iron.
    e. Ends: Flanged.
    f. Seats: PTFE or TFE.
    g. Stem: Stainless steel.
    h. Ball: Stainless steel.
    i. Port: Full.

3. 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. ABZ Valve and Controls; a division of ABZ Manufacturing, Inc.
    b. American Valve, Inc.
    c. Conbraco Industries, Inc.; Apollo Valves.

2.6 BRONZE SWING CHECK VALVES

A. Class 125, Bronze Swing Check Valves with Bronze Disc:

1. Manufacturers: Subject to compliance with requirements, **available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following**:

    a. American Valve, Inc.
    b. Crane Co.; Crane Valve Group; Crane Valves.
    c. Crane Co.; Crane Valve Group; Jenkins Valves.
    d. Crane Co.; Crane Valve Group; Stockham Division.
    e. Hammond Valve.
    f. Kitz Corporation.
    g. Milwaukee Valve Company.
    h. NIBCO INC.
    i. Powell Valves.
    j. Red-White Valve Corporation.
    k. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
    l. Zy-Tech Global Industries, Inc.

2. Description:

a. Standard: MSS SP-80, Type 3.
b. CWP Rating: 200 psig (1380 kPa).
c. Body Design: Horizontal flow.
d. Body Material: ASTM B 62, bronze.
e. Ends: Threaded.
f. Disc: Bronze.

B. Class 150, Bronze Swing Check Valves with Bronze Disc:

1. Manufacturers: Subject to compliance with requirements, **available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following**:

a. American Valve, Inc.
b. Crane Co.; Crane Valve Group; Crane Valves.
c. Crane Co.; Crane Valve Group; Jenkins Valves.
d. Crane Co.; Crane Valve Group; Stockham Division.
e. Kitz Corporation.
f. Milwaukee Valve Company.
g. NIBCO INC.
h. Red-White Valve Corporation.
i. Zy-Tech Global Industries, Inc.

2. Description:

a. Standard: MSS SP-80, Type 3.
b. CWP Rating: 300 psig (2070 kPa).
c. Body Design: Horizontal flow.
d. Body Material: ASTM B 62, bronze.
e. Ends: Threaded.
f. Disc: Bronze.
g. NPS 14 to NPS 24 (DN 350 to DN 600), CWP Rating: 300 psig (2070 kPa).

3. Manufacturers: Subject to compliance with requirements, **manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following**:

2.7 BRONZE GATE VALVES

A. Class 125, NRS Bronze Gate Valves:

1. Manufacturers: Subject to compliance with requirements, **available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following**:

a. American Valve, Inc.
b. Crane Co.; Crane Valve Group; Crane Valves.
c. Crane Co.; Crane Valve Group; Jenkins Valves.
d. Crane Co.; Crane Valve Group; Stockham Division.
e. Hammond Valve.

f. Kitz Corporation.
g. Milwaukee Valve Company.
h. NIBCO INC.
i. Powell Valves.
j. Red-White Valve Corporation.
k. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
l. Zy-Tech Global Industries, Inc.
m. <**Insert manufacturer's name**>.

2. Description:

a. Standard: MSS SP-80, Type 1.
b. CWP Rating: 200 psig (1380 kPa).
c. Body Material: ASTM B 62, bronze with integral seat and screw-in bonnet.
d. Ends: Threaded[**or solder joint**].
e. Stem: Bronze.
f. Disc: Solid wedge; bronze.
g. Packing: Asbestos free.
h. Handwheel: Malleable iron[**, bronze, or aluminum**].

B. Class 125, RS Bronze Gate Valves:

1. Manufacturers: Subject to compliance with requirements, **manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following**:

a. American Valve, Inc.
b. Crane Co.; Crane Valve Group; Crane Valves.
c. Crane Co.; Crane Valve Group; Jenkins Valves.
d. Crane Co.; Crane Valve Group; Stockham Division.
e. Hammond Valve.
f. Kitz Corporation.
g. Milwaukee Valve Company.
h. NIBCO INC.
i. Powell Valves.
j. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
k. Zy-Tech Global Industries, Inc.
l. <**Insert manufacturer's name**>.

2. Description:

a. Standard: MSS SP-80, Type 2.
b. CWP Rating: 200 psig (1380 kPa).
c. Body Material: ASTM B 62, bronze with integral seat and screw-in bonnet.
d. Ends: Threaded[**or solder joint**].
e. Stem: Bronze.
f. Disc: Solid wedge; bronze.
g. Packing: Asbestos free.
h. Handwheel: Malleable iron**, bronze, or aluminum**.

C. Class 150, NRS Bronze Gate Valves:

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. Hammond Valve.
    b. Kitz Corporation.
    c. Milwaukee Valve Company.
    d. NIBCO INC.
    e. Powell Valves.
    f. Red-White Valve Corporation.
    g. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

    a. Standard: MSS SP-80, Type 1.
    b. CWP Rating: 300 psig (2070 kPa).
    c. Body Material: ASTM B 62, bronze with integral seat and union-ring bonnet.
    d. Ends: Threaded.
    e. Stem: Bronze.
    f. Disc: Solid wedge; bronze.
    g. Packing: Asbestos free.
    h. Handwheel: Malleable iron[**, bronze, or aluminum**].

D. Class 150, RS Bronze Gate Valves:

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. Crane Co.; Crane Valve Group; Crane Valves.
    b. Crane Co.; Crane Valve Group; Stockham Division.
    c. Hammond Valve.
    d. Kitz Corporation.
    e. Milwaukee Valve Company.
    f. NIBCO INC.
    g. Powell Valves.
    h. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
    i. Zy-Tech Global Industries, Inc.

2. Description:

    a. Standard: MSS SP-80, Type 2.
    b. CWP Rating: 300 psig (2070 kPa).
    c. Body Material: ASTM B 62, bronze with integral seat and union-ring bonnet.
    d. Ends: Threaded.
    e. Stem: Bronze.
    f. Disc: Solid wedge; bronze.
    g. Packing: Asbestos free.
    h. Handwheel: Malleable iron[**, bronze, or aluminum**].

2.8 IRON GATE VALVES

A. Class 125, NRS, Iron Gate Valves:

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. Crane Co.; Crane Valve Group; Crane Valves.
b. Crane Co.; Crane Valve Group; Jenkins Valves.
c. Crane Co.; Crane Valve Group; Stockham Division.
d. Flo Fab Inc.
e. Hammond Valve.
f. Kitz Corporation.
g. Legend Valve.
h. Milwaukee Valve Company.
i. NIBCO INC.
j. Powell Valves.
k. Red-White Valve Corporation.
l. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
m. Zy-Tech Global Industries, Inc.

2. Description:

a. Standard: MSS SP-70, Type I.
b. NPS 2-1/2 to NPS 12 (DN 65 to DN 300), CWP Rating: 200 psig (1380 kPa).
c. NPS 14 to NPS 24 (DN 350 to DN 600), CWP Rating: 150 psig (1035 kPa).
d. Body Material: ASTM A 126, gray iron with bolted bonnet.
e. Ends: Flanged.
f. Trim: Bronze.
g. Disc: Solid wedge.
h. Packing and Gasket: Asbestos free.

B. Class 125, OS&Y, Iron Gate Valves:

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. Crane Co.; Crane Valve Group; Crane Valves.
b. Crane Co.; Crane Valve Group; Jenkins Valves.
c. Crane Co.; Crane Valve Group; Stockham Division.
d. Flo Fab Inc.
e. Hammond Valve.
f. Kitz Corporation.
g. Legend Valve.
h. Milwaukee Valve Company.
i. NIBCO INC.
j. Powell Valves.
k. Red-White Valve Corporation.
l. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
m. Zy-Tech Global Industries, Inc.

2. Description:

a. Standard: MSS SP-70, Type I.
b. NPS 2-1/2 to NPS 12 (DN 65 to DN 300), CWP Rating: 200 psig (1380 kPa).
c. NPS 14 to NPS 24 (DN 350 to DN 600), CWP Rating: 150 psig (1035 kPa).
d. Body Material: ASTM A 126, gray iron with bolted bonnet.
e. Ends: Flanged.
f. Trim: Bronze.
g. Disc: Solid wedge.
h. Packing and Gasket: Asbestos free.

C. Class 250, NRS, Iron Gate Valves:

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. Crane Co.; Crane Valve Group; Crane Valves.
b. Crane Co.; Crane Valve Group; Stockham Division.
c. NIBCO INC.

2. Description:

a. Standard: MSS SP-70, Type I.
b. NPS 2-1/2 to NPS 12 (DN 65 to DN 300), CWP Rating: 500 psig (3450 kPa).
c. NPS 14 to NPS 24 (DN 350 to DN 600), CWP Rating: 300 psig (2070 kPa).
d. Body Material: ASTM A 126, gray iron with bolted bonnet.
e. Ends: Flanged.
f. Trim: Bronze.
g. Disc: Solid wedge.
h. Packing and Gasket: Asbestos free.

D. Class 250, OS&Y, Iron Gate Valves:

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. Crane Co.; Crane Valve Group; Crane Valves.
b. Crane Co.; Crane Valve Group; Stockham Division.
c. Hammond Valve.
d. Milwaukee Valve Company.
e. NIBCO INC.
f. Powell Valves.
g. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

a. Standard: MSS SP-70, Type I.
b. NPS 2-1/2 to NPS 12 (DN 65 to DN 300), CWP Rating: 500 psig (3450 kPa).
c. NPS 14 to NPS 24 (DN 350 to DN 600), CWP Rating: 300 psig (2070 kPa).
d. Body Material: ASTM A 126, gray iron with bolted bonnet.
e. Ends: Flanged.

f. Trim: Bronze.
g. Disc: Solid wedge.
h. Packing and Gasket: Asbestos free.

2.9 BRONZE GLOBE VALVES

A. Class 125, Bronze Globe Valves with Bronze Disc:

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. Crane Co.; Crane Valve Group; Crane Valves.
b. Crane Co.; Crane Valve Group; Stockham Division.
c. Hammond Valve.
d. Kitz Corporation.
e. Milwaukee Valve Company.
f. NIBCO INC.
g. Powell Valves.
h. Red-White Valve Corporation.
i. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
j. Zy-Tech Global Industries, Inc.

2. Description:

a. Standard: MSS SP-80, Type 1.
b. CWP Rating: 200 psig (1380 kPa).
c. Body Material: ASTM B 62, bronze with integral seat and screw-in bonnet.
d. Ends: Threaded[**or solder joint**].
e. Stem and Disc: Bronze.
f. Packing: Asbestos free.
g. Handwheel: Malleable iron**, bronze, or aluminum**.

B. Class 125, Bronze Globe Valves with Nonmetallic Disc:

1. Manufacturers: Subject to compliance with requirements, **manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following**:

a. Crane Co.; Crane Valve Group; Crane Valves.
b. Crane Co.; Crane Valve Group; Stockham Division.
c. NIBCO INC.
d. Red-White Valve Corporation.
e. <**Insert manufacturer's name**>.

2. Description:

a. Standard: MSS SP-80, Type 2.
b. CWP Rating: 200 psig (1380 kPa).
c. Body Material: ASTM B 62, bronze with integral seat and screw-in bonnet.
d. Ends: Threaded[**or solder joint**].
e. Stem: Bronze.

f. Disc: PTFE or TFE.
g. Packing: Asbestos free.
h. Handwheel: Malleable iron[**, bronze, or aluminum**].

C. Class 150, Bronze Globe Valves with Nonmetallic Disc:

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. Crane Co.; Crane Valve Group; Crane Valves.
b. Hammond Valve.
c. Kitz Corporation.
d. Milwaukee Valve Company.
e. NIBCO INC.
f. Powell Valves.
g. Red-White Valve Corporation.
h. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
i. Zy-Tech Global Industries, Inc.

2. Description:

a. Standard: MSS SP-80, Type 2.
b. CWP Rating: 300 psig (2070 kPa).
c. Body Material: ASTM B 62, bronze with integral seat and union-ring bonnet.
d. Ends: Threaded.
e. Stem: Bronze.
f. Disc: PTFE or TFE.
g. Packing: Asbestos free.
h. Handwheel: Malleable iron[**, bronze, or aluminum**].

2.10 IRON GLOBE VALVES

A. Class 125, Iron Globe Valves:

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. Crane Co.; Crane Valve Group; Crane Valves.
b. Crane Co.; Crane Valve Group; Jenkins Valves.
c. Crane Co.; Crane Valve Group; Stockham Division.
d. Hammond Valve.
e. Kitz Corporation.
f. Milwaukee Valve Company.
g. NIBCO INC.
h. Powell Valves.
i. Red-White Valve Corporation.
j. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
k. Zy-Tech Global Industries, Inc.

2. Description:

a. Standard: MSS SP-85, Type I.
b. CWP Rating: 200 psig (1380 kPa).
c. Body Material: ASTM A 126, gray iron with bolted bonnet.
d. Ends: Flanged.
e. Trim: Bronze.
f. Packing and Gasket: Asbestos free.

B. Class 250, Iron Globe Valves:

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. Crane Co.; Crane Valve Group; Crane Valves.
b. Crane Co.; Crane Valve Group; Jenkins Valves.
c. Crane Co.; Crane Valve Group; Stockham Division.
d. Hammond Valve.
e. Milwaukee Valve Company.
f. NIBCO INC.
g. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

a. Standard: MSS SP-85, Type I.
b. CWP Rating: 500 psig (3450 kPa).
c. Body Material: ASTM A 126, gray iron with bolted bonnet.
d. Ends: Flanged.
e. Trim: Bronze.
f. Packing and Gasket: Asbestos free.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.

B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.

C. Examine threads on valve and mating pipe for form and cleanliness.

D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.

E. Do not attempt to repair defective valves; replace with new valves.

3.2 VALVE INSTALLATION

A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.

B. Locate valves for easy access and provide separate support where necessary.

C. Install valves in horizontal piping with stem at or above center of pipe.

D. Install valves in position to allow full stem movement.

E. Install check valves for proper direction of flow and as follows:

1. Swing Check Valves: In horizontal position with hinge pin level.
2. **Center-Guided and Plate-Type** Check Valves: In horizontal or vertical position, between flanges.
3. Lift Check Valves: With stem upright and plumb.

3.3 ADJUSTING

A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

3.4 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

A. If valve applications are not indicated, use the following:

1. Shutoff Service: Ball, butterfly**, or gate** valves.
2. Butterfly Valve Dead-End Service: Single-flange (lug) type.
3. Throttling Service except Steam: **Globe, ball, or butterfly** valves.
4. Pump-Discharge Check Valves:

   a. NPS 2 (DN 50) and Smaller: Bronze swing check valves with [**bronze d**isc.
   b. NPS 2-1/2 (DN 65) and Larger: Iron swing check valves with lever and weight or with spring or iron, center-guided, **metal** seat check valves.

B. If valves with specified SWP classes or CWP ratings are not available, the same types of valves with higher SWP classes or CWP ratings may be substituted.

C. Select valves, except wafer types, with the following end connections:

1. For Copper Tubing, NPS 2 (DN 50) and Smaller: Threaded ends except where solder-joint valve-end option is indicated in valve schedules below.
2. For Copper Tubing, NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Flanged ends except where threaded valve-end option is indicated in valve schedules below.
3. For Copper Tubing, NPS 5 (DN 125) and Larger: Flanged ends.
4. For Steel Piping, NPS 2 (DN 50) and Smaller: Threaded ends.
5. For Steel Piping, NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Flanged ends except where threaded valve-end option is indicated in valve schedules below.
6. For Steel Piping, NPS 5 (DN 125) and Larger: Flanged ends.

7. For Grooved-End [**Copper Tubing**] [**and**] [**Steel Piping**] except Steam and Steam Condensate Piping: Valve ends may be grooved.
8. Iron Ball Valves, NPS 2-1/2 to NPS 10 (DN 65 to DN 250): Class 150.
9. High-Performance Butterfly Valves: [**Class 150**] [**Class 300**], single flange.

END OF SECTION 15112

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 domestic water piping sized less than 6 inch diameter inside the building.

1.3 PERFORMANCE REQUIREMENTS

A. Provide components and installation capable of producing domestic water piping systems with 100 psig, unless otherwise indicated.

1.4 SUBMITTALS

A. Product Data: For pipe, tube, fittings, and couplings.

B. Field quality-control test reports.

1.5 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

B. Comply with NSF 61, "Drinking Water System Components - Health Effects; Sections 1 through 9," for potable domestic water piping and components.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

A. Refer to Part 3 "Pipe and Fitting Applications" Article for applications of pipe, tube, fitting, and joining materials.

B. Transition Couplings for Aboveground Pressure Piping: Coupling or other manufactured fitting the same size as, with pressure rating at least equal to and ends compatible with, piping to be joined.

2.2 COPPER TUBE AND FITTINGS

A. Hard Copper Tube: ASTM B 88, Types L and M (ASTM B 88M, Types B and C), water tube, drawn temper.

1. Copper Pressure Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint fittings. Furnish wrought-copper fittings if indicated.
2. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends. Furnish Class 300 flanges if required to match piping.
3. Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body, with ball-and-socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.

2.3 VALVES

A. Bronze and cast-iron, general-duty valves are specified in Section 15112 "General Duty Valves for Water Piping"

PART 3 - EXECUTION

3.1 EXCAVATION

A. Excavating, trenching, and backfilling are specified in Division 2 Section "Earthwork."

3.2 PIPE AND FITTING APPLICATIONS

A. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below, unless otherwise indicated.

B. Flanges may be used on aboveground piping, unless otherwise indicated.

C. Fitting Option: Extruded-tee connections and brazed joints may be used on aboveground copper tubing.

D. Aboveground Domestic Water Piping: Use any of the following piping materials for each size range:

1. NPS 1 (DN 25) and Smaller: Hard copper tube, Type L (Type B) or Type M (Type C); copper pressure fittings; and soldered joints.
2. NPS 1-1/4 and NPS 1-1/2 (DN 32 and DN 40): Hard copper tube, Type L (Type B) or Type M (Type C); copper pressure fittings; and soldered joints.
3. NPS 2 (DN 50): Hard copper tube, Type L (Type B) or Type M (Type C); copper pressure fittings; and soldered joints.
4. NPS 2 (DN 50): Hard copper tube, Type L (Type B) or Type M (Type C) with grooved ends; copper grooved-end fittings; grooved-end-tube couplings; and grooved joints.

3.3 VALVE APPLICATIONS

A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:

1. Shutoff Duty: Use bronze ball or gate valves for piping NPS 2 (DN 50) and smaller. Use cast-iron butterfly or gate valves with flanged ends for piping NPS 2-1/2 (DN 65) and larger.

2. Throttling Duty: Use bronze ball or globe valves for piping NPS 2 (DN 50) and smaller. Use cast-iron butterfly valves with flanged ends for piping NPS 2-1/2 (DN 65) and larger.
3. Drain Duty: Hose-end drain valves.

B. Install shutoff valve close to water main on each branch and riser serving plumbing fixtures or equipment, on each water supply to equipment, and on each water supply to plumbing fixtures that do not have supply stops. Use ball or gate valves for piping NPS 2 (DN 50) and smaller. Use butterfly or gate valves for piping NPS 2-1/2 (DN 65) and larger.

C. Install drain valves for equipment at base of each water riser, at low points in horizontal piping, and where required to drain water piping.

1. Install hose-end drain valves at low points in water mains, risers, and branches.

3.4 PIPING INSTALLATION

A. Basic piping installation requirements are specified in Division 15 Section "Basic Mechanical Materials and Methods."

B. Install under-building-slab copper tubing according to CDA's "Copper Tube Handbook."

C. Install wall penetration system at each service pipe penetration through foundation wall. Make installation watertight. Wall penetration systems are specified in Division 15 Section "Basic Mechanical Materials and Methods."

D. Install domestic water piping level and plumb.

E. Rough-in domestic water piping for water-meter installation according to utility company's requirements.

3.5 JOINT CONSTRUCTION

A. Basic piping joint construction requirements are specified in Division 15 Section "Basic Mechanical Materials and Methods."

B. Soldered Joints: Use ASTM B 813, water-flushable, lead-free flux; ASTM B 32, lead-free-alloy solder; and ASTM B 828 procedure, unless otherwise indicated.

3.6 HANGER AND SUPPORT INSTALLATION

A. Pipe hanger and support devices are specified in Division 15 Section "Hangers and Supports." Install the following:

1. Vertical Piping: MSS Type 8 or Type 42, clamps.
2. Individual, Straight, Horizontal Piping Runs: According to the following:

a. 100 Feet (30 m) and Less: MSS Type 1, adjustable, steel clevis hangers.
b. Longer Than 100 Feet (30 m): MSS Type 43, adjustable roller hangers.
c. Longer Than 100 Feet (30 m): MSS Type 49, spring cushion rolls, if indicated.

3. Multiple, Straight, Horizontal Piping Runs 100 Feet (30 m) or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
4. Base of Vertical Piping: MSS Type 52, spring hangers.

B. Install supports according to Division 15 Section "Hangers and Supports."

C. Support vertical piping and tubing at base and at each floor.

D. Rod diameter may be reduced 1 size for double-rod hangers, to a minimum of 3/8 inch (10 mm).

E. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 3/4 (DN 20) and Smaller: 60 inches (1500 mm) with 3/8-inch (10-mm) rod.
2. NPS 1 and NPS 1-1/4 (DN 25 and DN 32): 72 inches (1800 mm) with 3/8-inch (10-mm) rod.
3. NPS 1-1/2 and NPS 2 (DN 40 and DN 50): 96 inches (2400 mm) with 3/8-inch (10-mm) rod.

F. Install supports for vertical copper tubing every 10 feet (3 m).

3.7 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to equipment and machines to allow service and maintenance.

C. Connect domestic water piping to exterior water-service piping. Use transition fitting to join dissimilar piping materials.

D. Connect domestic water piping to water-service piping with shutoff valve, and extend and connect to the following:
1. Water Heaters: Cold-water supply and hot-water outlet piping in sizes indicated, but not smaller than sizes of water heater connections.
2. Plumbing Fixtures: Cold- and hot-water supply piping in sizes indicated, but not smaller than required by plumbing code. Refer to Division 15 Section "Plumbing Fixtures."
3. Equipment: Cold- and hot-water supply piping as indicated, but not smaller than equipment connections. Provide shutoff valve and union for each connection. Use flanges instead of unions for NPS 2-1/2 (DN 65) and larger.

3.8 FIELD QUALITY CONTROL

A. Inspect domestic water piping as follows:

1. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.
2. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:

a. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.

b. Final Inspection: Arrange final inspection for authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.

3. Re-inspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for re-inspection.
4. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

B. Test domestic water piping as follows:

1. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.
2. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
3. Leave new, altered, extended, or replaced domestic water piping uncovered and unconcealed until it has been tested and approved. Expose work that was covered or concealed before it was tested.
4. Cap and subject piping to static water pressure of 50 psig (345 kPa) above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
5. Repair leaks and defects with new materials and retest piping or portion thereof until satisfactory results are obtained.
6. Prepare reports for tests and required corrective action.

3.9 ADJUSTING

A. Perform the following adjustments before operation:

1. Close drain valves, hydrants, and hose bibbs.
2. Open shutoff valves to fully open position.
3. Open throttling valves to proper setting.

4. Remove plugs used during testing of piping and plugs used for temporary sealing of piping during installation.
5. Remove and clean strainer screens. Close drain valves and replace drain plugs.
6. Remove filter cartridges from housings and verify that cartridges are as specified for application where used and are clean and ready for use.
7. Check plumbing specialties and verify proper settings, adjustments, and operation.

3.10 CLEANING

A. Clean and disinfect potable domestic water piping as follows:

1. Purge new piping and parts of existing domestic water piping that have been altered, extended, or repaired before using.
2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction or, if methods are not prescribed, procedures described in either AWWA C651 or AWWA C652 or as described below:

a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
b. Fill and isolate system according to either of the following:

1) Fill system or part thereof with water/chlorine solution with at least 50 ppm (50 mg/L) of chlorine. Isolate with valves and allow to stand for 24 hours.
2) Fill system or part thereof with water/chlorine solution with at least 200 ppm (200 mg/L) of chlorine. Isolate and allow to stand for three hours.

c. Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.
d. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedures if biological examination shows contamination.

B. Prepare and submit reports of purging and disinfecting activities.

C. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

END OF SECTION 15140

PART 1 – GENERAL

1.01 DESCRIPTION

A. The General Provisions and other Mechanical Equipment and systems are specified in other Sections of Division 15.

B. This Section is intended to provide for all labor, materials, tools, equipment, services and supervision required to provide a complete system of thermal insulation for all water piping as herein specified and/or indicated on the drawings. Provide incidental items not indicated on the drawings nor mentioned in the specification that is required to provide a complete system.

C. Provide trained and experienced workmen with adequate supervision regularly employed in this type of work

D. Piping not to be Insulated:

1. Chromium Plated Brass Connections to Plumbing Fixtures
2. Underground Domestic Cold Water Piping
3. Piping installed in unit heater and funned tube radiation enclosures.

1.02 DEFINITIONS

A. Piping that can be seen when the building is complete without opening or removing access doors or panels is defined as being exposed.

B. All other piping is defined as being concealed.

1.03 APPLICATION

A. The application of all materials shall be subject to the manufacturer's recommended temperature limitations.

B. If the method of application for any particular insulating material or finish is not herein specified, then the application shall be in accordance that particular manufacturer's published recommendations.

1.04 All materials provided for this project shall be specified and listed by the manufacturer for the application intended ratings.

A. Unless otherwise specified, all insulation and accessories shall have a composite flame-spread rating of not more than 25 and a smoke developed rating of not more than 50 as determined by the Method of test of Surface Burning Characteristics of Building Materials, NFPA # 255, ASTM E-84 and UL 723. Insulation and accessories that are factory applied shall be tested as an assembly. Insulation and accessories that are field applied may be tested as individual components.

B. The treatment used on pipe jackets and ductwork facings to give flame-spread and smoke developed ratings shall be permanent. Water soluble, corrosive or fugitive type treatments shall not be used to give flame-spread and smoke developed ratings.

C. Insulation materials shall bear a label indicating the flame-spread and smoke developed ratings on the product.

D. The perm rating for vapor barriers shall be not more than 0.05 perms and the perm rating for adhesives, coatings and mastics shall be not more than 0.25 perms.

1.05 SUBMITTALS

A. Include manufacturer specification, flame spread rating, conductance rating, maximum operating temperature rating of insulation surface temperature and compliance standards and Submit certification prior to installation that materials to be used meet RATING for manufacture or production.

B. Include manufacturer's product information on adhesives tapes and cement compatible with the insulation product

1.06 ALTERNATE THICKNESSES

A. The specified thickness of the fiberglass insulation may be increased or reduced if materials having different thermal resistivity "K" than these herein listed. Submit calculations performed in accordance with ASHRAE 90a-1980, Section 5, together with manufacturer's documentation of the products performance.

2. PART 2 – PRODUCTS

2.01 MATERIALS

A. Products shall not contain asbestos, lead, mercury, or mercury compounds.

B. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.

C. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.

D. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

E. Materials of the manufacturers listed below may be used for the applications designated by the manufacturer and shall be compatible with the piping material with which they are used and shall not corrode, soften or in any way attack the piping material in either the wet or dry state.

F. Fiber Glass Pipe Covering:

1. Owens-Corning
2. Certainteed
3. Johns Manville
4. Dupont Knauf

G. Adhesives and Mastics:
1. Foster
2. Childers
3. Epolux
4. Lion Oil
5. Vimasco

H. Preformed Fittings:
1. Moulded Acoustic
2. North Brothers
3. Extrol
4. Speed-Line
5. Star-Davis

E. Insulating Cements: Asbestos Free
1. Fibrex
2. Keene
3. Pabco
4. Ramco
5. Rock Wool Manufacturing Company

3. PART 3 – EXECUTION

3.01 APPLICATION

A. All surfaces to be insulated shall be clean and dry and free of all rust, dirt, scale, etc., and all pressure tests shall be completed prior to installing insulation.

B. The insulation materials shall be clean and dry when installed and when finish is being applied.

C. Insulation materials shall be installed with smooth and even surfaces without bulges, protrusions, raw edges or wrinkles. The jackets shall be drawn tight and secured smoothly at longitudinal and end laps with adhesive.

D. Except for vapor barrier, the twisted ends of banding wires shall be turned down into the insulation.

E. Open ends of exposed pipe insulation shall be finished as specified for fittings.

F. Hollow pipe covering protection saddles shall be filled with fiberglass insulation.

G. Staples will not be permitted on exposed pipe insulation.

H. Staples used on cold pipe, ductwork or equipment shall be vapor sealed with vapor barrier coating.

I. Where pipes pass through sleeves, the insulation shall continue full thickness through the sleeve.

J. Multiple layer insulation shall be installed with the joints staggered. The inner layer shall be secured with wire on 9" centers and the outer layer shall be finished as specified for single layer.

3.02 HOT PIPE INSULATION

A. Insulate Domestic Hot Water pipe and fittings for operating temperatures forty (40) through one hundred and eighty (180) degrees Fahrenheit with 1 inch thick preformed fiberglass or equal pipe insulation, maximum "K" value of 0.28 at mean temperature of 75 degrees F, with white all service jacket with self-sealing lap.

B. Insulation shall be installed with jackets drawn tight and with longitudinal laps and end joint strips adhered. End joint strips shall be not less than 3" wide and of identical materials as the jacket.

C. Fittings shall be insulated with preformed or mitered fiberglass fittings of the same thickness and composition as the adjacent pipe insulation. Fittings shall be wired in place, covered with a smoothing coat of finishing cements and finished with glass fabric embedded in a coat of mastic. Glass fabric shall overlap adjacent insulation not less than 2". White fabric and mastic shall be used on exposed fittings.

3.03 COLD PIPE INSULATION

A. Insulate pipe and fittings for:

1. Domestic cold water and horizontal drinking fountain waste with preformed fiberglass or equal pipe insulation with maximum "K" value of 0.28 at mean temperature of 75 degrees F, ½" thick for domestic water piping, (1" thick for piping in Mechanical rooms) 1" thick for piping adjacent to outside louvers, 1" thick for exterior piping, vapor barrier and white all service jacket with self-sealing lap.

2. Install insulation with jacket drawn tight with side-laps and end joint butt strips secured. End joint butt strips shall be same material as jacket, not less than 3"

wide. Sectionally seal all butt ends at fittings and every 21' of straight runs with white vapor barrier coating.

3. Insulate fittings, with preformed or mitered fiberglass fittings of equal thickness and composition to adjacent pipe insulation. Wire fittings in place and vapor seal with a layer of glass fabric embedded between two 1/16"coats of white vapor barrier coating. Glass fabric shall overlap adjoining insulation at least 2".

4. Mitered fittings shall receive a smoothing coat of hydraulic setting cement prior to finishing.

3.04 CEMENT FINISH

A. Cement finish shall be mineral wool cement not less than ½"thick troweled to a smooth hard finish.

3.05 PROTECTION

A. Where insulated pipes pass through sleeves the insulation inside the sleeve shall be covered with a #20 gauge aluminum protector held in place with aluminum screws. The protectors shall pass through the sleeves.

B. For insulation protectors at hangers see "HANGERS AND SUPPORTS" – SECTION 15090.

3.06 HANDICAP PROTECTION

A. Handicap lavatory P-trap and hot and cold angle valve assemblies shall be insulated with the fully molded, TRUEBRO, Handi Lav-Guard or approved equal insulation kit, Model # 102/105, light gray color with 3-piece interlocking trap assembly and 2-piece interlocking angle valve assemblies. Fasteners shall be nylon-type supplied with kit.

3.07 WEATHER PROOFING

A. Protect insulation exposed to weather outside the building with 0.010" thick corrugated aluminum covers on piping up to 10", 0.16 thick on 10" and larger piping. Locate longitudinal joints to shed water and secure with 3 aluminum bands per section. Cover fittings with preformed aluminum fitting covers or a layer of vinyl acrylic or breathing mastic, overlapping adjacent aluminum at least 2".

3.08 INSULATION SCHEDULE

A. All hot and cold water piping in the building and exterior soffits shall be insulated with acceptable preformed pipe and tubular insulation materials and thicknesses for each piping system and pipe size range.

B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:

1. Drainage piping located in crawl spaces.
2. Underground piping.
3. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

End of Section

-SECTION 15410 – PLUMBING FIXTURES

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 conventional plumbing fixtures and related components:

1. Faucets for lavatories.
2. Flush-o-meters.
3. Toilet seats.
4. Protective shielding guards.
5. Fixture supports.
6. Water closets.
7. Lavatories.
8. Service sinks.

B. Related Sections include the following:

1. Division 10 Section "Toilet and Bath Accessories."
2. Division 15 Section "Drinking Fountains and Water Coolers."

1.3 DEFINITIONS

A. Accessible Fixture: Plumbing fixture that can be approached, entered, and used by people with disabilities.

B. Cast Polymer: Cast-filled-polymer-plastic material. This material includes cultured-marble and solid-surface materials.

C. Cultured Marble: Cast-filled-polymer-plastic material with surface coating.

D. Fitting: Device that controls the flow of water into or out of the plumbing fixture. Fittings specified in this Section include supplies and stops, faucets and spouts, shower heads and tub spouts, drains and tailpieces, and traps and waste pipes. Piping and general-duty valves are included where indicated.

E. FRP: Fiberglass-reinforced plastic.

F. PMMA: Polymethyl methacrylate (acrylic) plastic.

G. PVC: Polyvinyl chloride plastic.

H. Solid Surface: Nonporous, homogeneous, cast-polymer-plastic material with heat-, impact-, scratch-, and stain-resistance qualities.

1.4 SUBMITTALS

A. Product Data: For each type of plumbing fixture indicated. Include selected fixture and trim, fittings, accessories, appliances, appurtenances, equipment, and supports. Indicate materials and finishes, dimensions, construction details, and flow-control rates.

B. Shop Drawings: Circuit Diagrams for power, signal, and control wiring.

C. Operation and Maintenance Data: For plumbing fixtures to include in emergency, operation, and maintenance manuals.

D. Warranty: Special warranty specified in this Section.

E. Source Limitations: Obtain plumbing fixtures, faucets, and other components of each category through one source from a single manufacturer.

1. Exception: If fixtures, faucets, or other components are not available from a single manufacturer, obtain similar products from other manufacturers specified for that category.

F. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

G. Regulatory Requirements: Comply with requirements in ICC A117.1, "Accessible and Usable Buildings and Facilities" for plumbing fixtures for people with disabilities.

H. Regulatory Requirements: Comply with requirements in Public Law 102-486, "Energy Policy Act," about water flow and consumption rates for plumbing fixtures.

I. NSF Standard: Comply with NSF 61, "Drinking Water System Components--Health Effects," for fixture materials that will be in contact with potable water.

J. Select combinations of fixtures and trim, faucets, fittings, and other components that are compatible.

K. Comply with the following applicable standards and other requirements specified for plumbing fixtures:
1. Porcelain-Enameled, Formed-Steel Fixtures: ASME A112.19.4M.
2. Vitreous-China Fixtures: ASME A112.19.2M.
3. Water-Closet, Flush Valve, Tank Trim: ASME A112.19.5.
4. Water-Closet, Flush-o-meter Tank Trim: ASSE 1037.

L. Stainless steel 14 guage combination lavatory / toilet. Toilet shall 1.28 gallon flush, blow out type requiring 35 PSI min flushing pressure and complies with ASME A112.19.3
1. With elongated bowl integral crevice free draining and flushing rim
2. Fully enclosed 2-1/2” OD trap
3. Stainless steel bubbler
4. Fast drain with air vent

5. Surfaces polished to #4 satin finish

M. Comply with the following applicable standards and other requirements specified for lavatory and sink faucets:
1. NSF Potable-Water Materials: NSF 61.
2. Pipe Threads: ASME B1.20.1.
3. Supply Fittings: ASME A112.18.1.
4. Brass Waste Fittings: ASME A112.18.2.

N. Comply with the following applicable standards and other requirements specified for miscellaneous fittings:
1. Brass and Copper Supplies: ASME A112.18.1.
2. Manual-Operation Flush-o-meters: ASSE 1037.
3. Brass Waste Fittings: ASME A112.18.2.

O. Comply with the following applicable standards and other requirements specified for miscellaneous components:
1. Flexible Water Connectors: ASME A112.18.6.
2. Floor Drains: ASME A112.6.3.
3. Grab Bars: ASTM F 446.
4. Hose-Coupling Threads: ASME B1.20.7.
5. Pipe Threads: ASME B1.20.1.
6. Plastic Toilet Seats: ANSI Z124.5.
7. Supply and Drain Protective Shielding Guards: ICC A117.1.

PART 2 - PRODUCTS

Part 2 articles specify typical plumbing fixtures and components. Retain and edit only those articles applicable to Project.

2.1 LAVATORY FAUCETS

A. Lavatory Faucets

1. Description: Two-handle mixing valve for sink in triage room with arm operated levers . Include hot- and cold-water indicators; coordinate faucet inlets with supplies and fixture holes; coordinate outlet with goose neck spout and fixture receptor.

2. Description: Single-handle mixing valve for lavatories and kitchen sinks. Include hot- and cold-water indicators; coordinate faucet inlets with supplies and fixture holes; coordinate outlet with spout and fixture receptor.

3.

a. Body Material: Commercial, solid brass.
b. Finish: Polished chrome plate.
c. Maximum Flow Rate: 2.2 GPM (8.3 L/min.).
d. Centers: 4 inches (102 mm).
e. Mounting: Deck, exposed.
f. Valve Handle(s): Lever.
g. Inlet(s): NPS 1/2 (DN 15) male adaptor.
h. Spout: Rigid type.

i. Spout Outlet: Aerator.
j. Operation: Compression, manual.
k. Drain: Pop up.
l. Tempering Device: Pressure balance.

2.2 FLUSH-O-METERS

A. Flush-o-meters

1. Description: Flush-o-meter for water-closet-type fixture. Include brass body with corrosion-resistant internal components, control stop with check valve, vacuum breaker, copper or brass tubing, and polished chrome-plated finish on exposed parts.

a. Internal Design: Diaphragm or piston operation.
b. Style: Exposed.
c. Inlet Size: NPS 3/4 (DN 20).
d. Trip Mechanism: Oscillating, lever-handle actuator.
e. Consumption: 1.20 gal./flush (3.8 L/flush) for lavatories 0.5 ga//flush for urinals
f. Tailpiece Size: NPS 3/4 (DN 20) and standard length to top of bowl.

2.3 TOILET SEATS

A. Toilet Seats:

1. Description: Toilet seat for water-closet-type fixture.

a. Material: Molded, solid plastic.
b. Configuration: Open front with cover.
c. Size: Elongated.
d. Hinge Type: SC, self-sustaining, check.
e. Class: Standard commercial.
f. Color: White.

2.4 PROTECTIVE SHIELDING GUARDS

A. Protective Shielding Pipe Covers:

1. Description: Manufactured plastic wraps for covering plumbing fixture hot-water supply and trap and drain piping. Comply with Americans with Disabilities Act (ADA) requirements.

2.5 SHOWER FAUCETS

A. Description: Single-handle mixing valve with anti-scalding control. Include hot- and cold-water indicators; coordinate faucet inlets with supplies and fixture holes; coordinate outlet with spout and fixture receptor

a. Body Material: Commercial, solid brass.

b. Finish: Polished chrome plate.

c. Maximum Flow Rate: 2.0 GPM (7.5 L/min.)

d. Shower head to be selected in the field

2.6 FIXTURE SUPPORTS

A. Water-Closet Supports:

1. Description: Combination carrier designed for accessible mounting height of wall-mounting, water-closet-type fixture. Include single or double, vertical or horizontal, hub-and-spigot or hub less waste fitting as required for piping arrangement; faceplates; couplings with gaskets; feet; and fixture bolts and hardware matching fixture. Include additional extension coupling, faceplate, and feet for installation in wide pipe space

B. Urinal Supports

1. Wall hung siphon jet urinal. The urinal shall be fitted with a chair carrier. Comply with ADA requirements. Coordinate with manufacturer

C. Lavatory Supports:

1. Description: Type II, lavatory carrier with concealed arms and tie rod for wall-mounting, lavatory-type fixture. Include steel uprights with feet.
2. Accessible-Fixture Support: Include rectangular steel uprights.

2.7 WATER CLOSETS

A. Water Closets:

1. Description: Accessible, wall-mounting, wall-outlet, vitreous-china fixture designed for flush-o-meter valve operation.
   a. Style: Flush-o-meter valve.
      1) Bowl Type: Elongated with blow out jet design. Include bolt caps matching fixture.
      2) Height: Accessible.
      3) Design Consumption: 1.2 gal./flush (6 L/flush).
      4) Color: White.

B. Water Closets:

1. Description: Accessible, floor-mounting, back-outlet, vitreous-china fixture designed for gravity-tank operation.

a. Style: Close coupled.

1) Bowl Type: Elongated with siphon-jet design. Include bolt caps matching fixture.
2) Height: Accessible.
3) Design Consumption: 1.2gal./flush (6 L/flush).
4) Tank: Gravity type with trim. Include cover.
5) Trip Mechanism: Lever-handle actuator.
6) Color: White.

b. Supply: NPS 1/2 (DN 15) chrome-plated brass or copper with wheel-handle stop.

2.8 LAVATORIES

A. Lavatories

1. Description: Accessible, wall-mounting, vitreous-china fixture.

a. Type: With back.
b. Size: 18 by 15 inches (457 by 381 mm) rectangular.
c. Faucet Hole Punching: Three holes, 4-inch (102-mm) centers.
d. Faucet Hole Location: Top.
e. Pedestal: Not required.
f. Color: White.
g. Faucet: Lavatory with pop-up waste.
h. Supplies: NPS 3/8 (DN 10) chrome-plated copper with stops.
i. Drain: See faucet. Location: Near back of bowl. Drain Piping: NPS 1-1/4 by NPS 1-1/2 (DN 32 by DN 40) chrome-plated, cast-brass P-trap; NPS 1-1/2 (DN 40), 0.032-inch- (0.8-mm-) thick tubular brass waste to wall; and wall escutcheon.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before plumbing fixture installation.

B. Examine cabinets, counters, floors, and walls for suitable conditions where fixtures will be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Assemble plumbing fixtures, trim, fittings, and other components according to manufacturers' written instructions.

B. Install off-floor supports, affixed to building substrate, for wall-mounting fixtures.

1. Use carrier supports with waste fitting and seal for back-outlet fixtures.
2. Use carrier supports without waste fitting for fixtures with tubular waste piping.
3. Use chair-type carrier supports with rectangular steel uprights for accessible fixtures.

C. Install back-outlet, wall-mounting fixtures onto waste fitting seals and attach to supports.

D. Install floor-mounting fixtures on closet flanges or other attachments to piping or building substrate.

E. Install wall-mounting fixtures with tubular waste piping attached to supports.

F. Install floor-mounting, back-outlet water closets attached to building floor substrate and wall bracket and onto waste fitting seals.

G. Install fixtures level and plumb according to roughing-in drawings.

H. Install water-supply piping with stop on each supply to each fixture to be connected to water distribution piping. Attach supplies to supports or substrate within pipe spaces behind fixtures. Install stops in locations where they can be easily reached for operation.

1. Exception: Use ball, gate, or globe valves if supply stops are not specified with fixture. Valves are specified in Division 15 Section "Valves."

I. Install trap and tubular waste piping on drain outlet of each fixture to be directly connected to sanitary drainage system.

J. Install tubular waste piping on drain outlet of each fixture to be indirectly connected to drainage system.

K. Install flush-o-meter valves for accessible water closets with handle mounted on wide side of compartment. Install other actuators in locations that are easy for people with disabilities to reach.

L. Install tanks for accessible, tank-type water closets with lever handle mounted on wide side of compartment.

M. Install toilet seats on water closets.

N. Install faucet-spout fittings with specified flow rates and patterns in faucet spouts if faucets are not available with required rates and patterns. Include adapters if required.

O. Install water-supply flow-control fittings with specified flow rates in fixture supplies at stop valves.

P. Install faucet flow-control fittings with specified flow rates and patterns in faucet spouts if faucets are not available with required rates and patterns. Include adapters if required.

Q. Install traps on fixture outlets.

1. Exception: Omit trap on fixtures with integral traps.

2. Exception: Omit trap on indirect wastes, unless otherwise indicated.

R. Install escutcheons at piping wall ceiling penetrations in exposed, finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding fittings. Escutcheons are specified in Division 15 Section "Basic Mechanical Materials and Methods."

S. Seal joints between fixtures and walls, floors, and countertops using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Sealants are specified in Division 7 Section "Joint Sealants."

3.3 CONNECTIONS

A. Piping installation requirements are specified in other Division 15 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures and comply with the manufacturer’s specific instructions

3.4 FIELD QUALITY CONTROL

A. Verify that installed plumbing fixtures are categories and types specified for locations where installed.

B. Check that plumbing fixtures are complete with trim, faucets, fittings, and other specified components.

C. Inspect installed plumbing fixtures for damage. Replace damaged fixtures and components.

D. Test installed fixtures after water systems are pressurized for proper operation. Replace malfunctioning fixtures and components, then retest. Repeat procedure until units operate properly.

3.5 ADJUSTING

A. Operate and adjust faucets and controls. Replace damaged and malfunctioning fixtures, fittings, and controls.

B. Adjust water pressure at faucets and flush-o-meter valves to produce proper flow and stream.

C. Replace washers and seals of leaking and dripping faucets and stops.

3.6 CLEANING

A. Clean fixtures, faucets, and other fittings with manufacturers' recommended cleaning methods and materials. Do the following:

1. Remove faucet spouts and strainers, remove sediment and debris, and reinstall strainers and spouts.
2. Remove sediment and debris from drains.

B. After completing installation of exposed, factory-finished fixtures, faucets, and fittings, inspect exposed finishes and repair damaged finishes.

3.7 PROTECTION

A. Provide protective covering for installed fixtures and fittings.

B. Do not allow use of plumbing fixtures for temporary facilities unless approved in writing by Owner.

END OF SECTION 15410

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 packaged, outdoor, central-station air-handling units (rooftop units) with the following components and accessories:

1. Direct-expansion cooling.
2. Heat-pump refrigeration components.
3. Hot-gas reheat.
4. Electric-heating coils.
5. Gas furnace.
6. Economizer outdoor- and return-air damper section.
7. Integral, space temperature controls.
8. Roof curbs.

1.3 DEFINITIONS

A. DDC: Direct-digital controls.

B. ECM: Electrically commutated motor.

C. Outdoor-Air Refrigerant Coil: Refrigerant coil in the outdoor-air stream to reject heat during cooling operations and to absorb heat during heating operations. "Outdoor air" is defined as the air outside the building or taken from outdoors and not previously circulated through the system.

D. Outdoor-Air Refrigerant-Coil Fan: The outdoor-air refrigerant-coil fan in RTUs. "Outdoor air" is defined as the air outside the building or taken from outdoors and not previously circulated through the system.

E. RTU: Rooftop unit. As used in this Section, this abbreviation means packaged, outdoor, central-station air-handling units. This abbreviation is used regardless of whether the unit is mounted on the roof or on a concrete base on ground.

F. Supply-Air Fan: The fan providing supply air to conditioned space. "Supply air" is defined as the air entering a space from air-conditioning, heating, or ventilating apparatus.

G. Supply-Air Refrigerant Coil: Refrigerant coil in the supply-air stream to absorb heat (provide cooling) during cooling operations and to reject heat (provide heating) during heating operations. "Supply air" is defined as the air entering a space from air-conditioning, heating, or ventilating apparatus.

H. VVT: Variable-air volume and temperature.

I. PE: Powered exhaust for the RTU

1.4 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design RTU supports to comply with [**wind**] [**and**] [**seismic**] performance requirements, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Wind-Restraint Performance:

1. Basic Wind Speed: **90 MPH**
2. Building Classification Category: **II**
3. Minimum 10 lb/sq. ft (48.8 kg/sq. m) multiplied by the maximum area of the mechanical component projected on a vertical plane that is normal to the wind direction, and 45 degrees either side of normal.

C. Seismic Performance: RTUs shall withstand the effects of earthquake motions determined according to **SEI/ASCE 7-10**.

1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."

1.5 SUBMITTALS

A. Product Data: Include manufacturer's technical data for each RTU, including rated capacities, dimensions, required clearances, characteristics, furnished specialties, and accessories.

B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

1. Wiring Diagrams: Power, signal, and control wiring.

2. By note confirm coordination of shop drawings for each roof top unit with the structural engineer and the structural drawings.

3. By note confirm coordination of shop drawings for each roof top unit with the architectural drawings and the related flashing required.

C. Manufacturer Wind Loading Qualification Certification: Submit certification that specified equipment will withstand wind forces identified in ASCE 7-10."

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculations.
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of wind force and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

D. Manufacturer Seismic Qualification Certification: Submit certification that RTUs, accessories, and components will withstand seismic forces defined in "International Building Code 2012 edition".

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.

2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

E. Coordination Drawings: Plans and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Structural members to which RTUs roof curbs will be attached.
2. Roof openings
3. Roof curbs and flashing.

F. Field quality-control test reports.

G. Operation and Maintenance Data: For RTUs to include in emergency, operation, and maintenance manuals.

H. Warranty: Special warranty specified in this Section.

1.6 QUALITY ASSURANCE

A. ARI Compliance:

1. Comply with ARI 210/240 and ARI 340/360 for testing and rating energy efficiencies for RTUs.
2. Comply with ARI 270 for testing and rating sound performance for RTUs.

B. ASHRAE Compliance:

1. Comply with ASHRAE 15 for refrigeration system safety.
2. Comply with ASHRAE 33 for methods of testing cooling and heating coils.
3. Comply with applicable requirements in ASHRAE 62.1-2004, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."

C. ASHRAE/IESNA 90.1-2004 Compliance: Applicable requirements in ASHRAE/IESNA 90.1-2004, Section 6 - "Heating, Ventilating, and Air-Conditioning."

D. NFPA Compliance: Comply with NFPA 90A and NFPA 90B.

E. UL Compliance: Comply with UL 1995.

F. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1.7 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to replace components of RTUs that fail in materials or workmanship within specified warranty period.

1. Warranty Period for Compressors: Manufacturer's standard, but not less than **10** years from date of Substantial Completion.

2. Warranty Period for Gas Furnace Heat Exchangers: Manufacturer's standard, but not less than **five** years from date of Substantial Completion.
3. Warranty Period for Solid-State Ignition Modules: Manufacturer's standard, but not less than five years from date of Substantial Completion.
4. Warranty Period for Control Boards: Manufacturer's standard, but not less than ten years from date of Substantial Completion.

1.8 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Fan Belts: **One set** for each belt-driven fan.
2. Filters: **One set** of filters for each unit.

B. Furnish spare fuses as described below
1. Control Fuses: Two sets for each type of unit
2. Power fuses: One set for each type of unit

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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:

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

C. Basis-of-Design Product: Subject to compliance with requirements, provide **the product indicated on Drawings**:
1. Carrier
2. Trane; American Standard Companies, Inc.
3. Bryant
4. Lennox
5. York
6. Or Equal Approved by the Owner

2.2 CASING

A. General Fabrication Requirements for Casings: Formed and reinforced double-wall insulated panels, fabricated to allow removal for access to internal parts and components, with joints between sections sealed.

B. Exterior Casing Material: Galvanized steel with factory-painted finish, with pitched roof panels and knockouts with grommet seals for electrical and piping connections and lifting lugs.

1. Exterior Casing Thickness: **0.052 inch (1.3 mm)** thick.

C. Inner Casing Fabrication Requirements:

1. Inside Casing: Galvanized steel, **0.034 inch (0.86 mm** thick**, perforated 40 percent free area**

D. Casing Insulation and Adhesive: Comply with NFPA 90A or NFPA 90B.

1. Materials: ASTM C 1071, Type I.
2. Thickness: **1/2 inch (13 mm)**
3. Liner materials shall have air-stream surface coated with an erosion- and temperature-resistant coating or faced with a plain or coated fibrous mat or fabric.
4. Liner Adhesive: Comply with ASTM C 916, Type I.

E. Condensate Drain Pans: Formed sections of **galvanized** sheet, a minimum of 2 inches (50 mm) deep**, and complying with ASHRAE 62.1-2004**.

1. Double-Wall Construction: Fill space between walls with foam insulation and seal moisture tight.
2. Drain Connections: Threaded nipple **both sides of drain pan**.
3. Pan-Top Surface Coating: Corrosion-resistant compound.

F. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1-2004.

2.3 FANS

A. Direct-Driven Supply-Air Fans: Double width, **forward curved**, centrifugal; with permanently lubricated, **multispeed ECM** motor resiliently mounted in the fan inlet. Aluminum or painted-steel wheels, and galvanized- or painted-steel fan scrolls.

B. Belt-Driven Supply-Air Fans: Double width, forward curved, centrifugal; with permanently lubricated, single-speed motor installed on an adjustable fan base resiliently mounted in the casing. Aluminum or painted-steel wheels, and galvanized- or painted-steel fan scrolls.

C. Condenser-Coil Fan: Propeller, mounted on shaft of permanently lubricated motor.

D. Relief-Air Fan: **Propeller**, shaft mounted on permanently lubricated motor.

E. Seismic Fabrication Requirements: Fabricate fan section, internal mounting frame and attachment to fans, fan housings, motors, casings, accessories, and other fan section components with reinforcement strong enough to withstand seismic forces defined in Division 15 Section "Vibration and Seismic Controls for HVAC Piping and Equipment" when fan-mounted frame and RTU-mounted frame are anchored to building structure.

F. Fan Motor: Comply with requirements in Division 15 Mechanical General Requirements ."

2.4 COILS

A. Supply-Air Refrigerant Coil:

1. **Aluminum** plate fin and seamless copper tube in steel casing with equalizing-type vertical distributor.
2. Polymer strip shall prevent all copper coil from contacting steel coil frame or condensate pan.
3. Coil Split: Interlaced.

4. Condensate Drain Pan: **Galvanized steel with corrosion-resistant coating** formed with pitch and drain connections **complying with ASHRAE 62.1-2004**.

B. Outdoor-Air Refrigerant Coil:

1. **Aluminum**-plate fin and seamless **internally grooved** copper tube in steel casing with equalizing-type vertical distributor.
2. Polymer strip shall prevent all copper coil from contacting steel coil frame or condensate pan.
3. **Baked phenolic** coating.

C. Hot-Gas Reheat Refrigerant Coil:

1. **Aluminum** plate fin and seamless **internally grooved** copper tube in steel casing with equalizing-type vertical distributor.
2. Polymer strip shall prevent all copper coil from contacting steel coil frame or condensate pan.
3. **Baked phenolic** coating.

2.5 REFRIGERANT CIRCUIT COMPONENTS

A. Number of Refrigerant Circuits: **One**.

B. Compressor: **Hermetic, scroll**, mounted on vibration isolators; with internal overcurrent and high-temperature protection, internal pressure relief**, and crankcase heater**.

C. Refrigeration Specialties:
1. Refrigerant:
2. R-410A.
3. Expansion valve with replaceable thermostatic element.
4. Refrigerant filter/dryer.
5. Manual-reset high-pressure safety switch.
6. Automatic-reset low-pressure safety switch.
7. Minimum off-time relay.
8. Automatic-reset compressor motor thermal overload.
9. Brass service valves installed in compressor suction and liquid lines.
10. Low-ambient kit high-pressure sensor.
11. Hot-gas reheat solenoid valve with a replaceable magnetic coil.
12. Hot-gas bypass solenoid valve with a replaceable magnetic coil.
13. Four-way reversing valve with a replaceable magnetic coil, thermostatic expansion valves with bypass check valves, and a suction line accumulator.

2.6 AIR FILTRATION

A. Minimum “arrestance” according to ASHRAE 52.1, and a minimum efficiency reporting value (MERV) according to ASHRAE 52.2.
1. Pleated: Minimum **90** percent “arrestance”, and MERV **7**.

2.7 GAS FURNACE

A. Description: Factory assembled, piped, and wired; complying with ANSI Z21.47 and NFPA 54.

1. CSA Approval: Designed and certified by and bearing label of CSA.

B. Burners: Stainless steel.

1. Fuel: **Natural** gas.
2. Ignition: Electronically controlled electric spark or hot-surface igniter with flame sensor.

C. Heat-Exchanger and Drain Pan: Stainless steel.

D. Venting: Gravity vented **with vertical extension**.

E. Safety Controls:

1. Gas Control Valve: **Single stage**
2. Gas Train: Single-body, regulated, redundant, 24-V ac gas valve assembly containing pilot solenoid valve, pilot filter, pressure regulator, pilot shutoff, and manual shutoff.

2.8 DAMPERS

A. Outdoor-Air Damper: Linked damper blades, for 0 to 25 percent outdoor air, with **motorized** damper.

B. Outdoor- and Return-Air Mixing Dampers: Parallel- or opposed-blade galvanized-steel dampers mechanically fastened to cadmium plated for galvanized-steel operating rod in reinforced cabinet. Connect operating rods with common linkage and interconnect linkages so dampers operate simultaneously.

1. Damper Motor: Modulating with adjustable minimum position.
2. Relief-Air Damper: Gravity actuated or motorized, as required by ASHRAE/IESNA 90.1-2004, with bird screen and hood.

2.9 ELECTRICAL POWER CONNECTION

A. Provide for single connection of power to unit with **unit-mounted disconnect switch accessible from outside unit and** control-circuit transformer with built-in overcurrent protection.

2.10 CONTROLS

A. Control equipment and sequence of operation are specified in Division 15 Section "HVAC Instrumentation and Controls."

B. Basic Unit Controls:

1. Control-voltage transformer.
2. Wall-mounted programmable thermostat or sensor with the following features:

a. Heat-cool-off switch.
b. Fan on-auto switch.
c. Fan-speed switch.
d. Manual or **Automatic**] changeover.
e. Adjustable dead band.

f. **Exposed** set point.
g. **Exposed** indication.
h. **Degree F** indication.
i. Programmable Unoccupied period with-override push button.
j. Data entry and access port to input temperature[**and humidity**] set points, occupied and unoccupied periods, and output room temperature[**and humidity**], supply-air temperature, operating mode, and status.
k. Interface facility with fire alarm system and duct smoke detector

3. Wall-mounted humidistat or sensor with the following features:

a. **Exposed** set point.
b. **Exposed** indication.

4. **Remote** -Mounted Annunciator Panel for Each Unit:

a. Lights to indicate power on, cooling, heating, fan running, filter dirty, and unit alarm or failure.
b. DDC controller or programmable timer and interface with HVAC instrumentation and control system.
c. Digital display of outdoor-air temperature, supply-air temperature, return-air temperature, economizer damper position, indoor-air quality, and control parameters.

C. **DDC**] Controller:

1. Controller shall have volatile-memory backup.
2. Safety Control Operation:

a. Smoke Detectors: Stop fan and close outdoor-air damper if smoke is detected. Provide additional contacts for alarm interface to fire alarm control panel.
b. Fire Alarm Control Panel Interface: Provide control interface to coordinate with operating sequence described in Division 13 Section "Fire Alarm."
c. Low-Discharge Temperature: Stop fan and close outdoor-air damper if supply air temperature is less than **40 deg F (4 deg C)**
d. Defrost Control for Condenser Coil: Pressure differential switch to initiate defrost sequence.

3. Scheduled Operation: Occupied and unoccupied periods on **seven**-day clock with a minimum of **four** programmable periods per day.
4. Unoccupied Period:

a. Heating Setback: **10 deg F (5.6 deg C)**
b. Cooling Setback: System off.
c. Override Operation: [**Two**] hours.

5. Supply Fan Operation:

a. Occupied Periods: Run fan continuously.
b. Unoccupied Periods: Cycle fan to maintain setback temperature.

6. Refrigerant Circuit Operation:

a. Occupied Periods: Cycle or stage compressors **, and operate hot-gas bypass** to match compressor output to cooling load to maintain **discharge** temperature **and**

humidity. Cycle condenser fans to maintain maximum hot-gas pressure. Operate low-ambient control kit to maintain minimum hot-gas pressure.

b. Unoccupied Periods: **Compressors off** [**Cycle compressors and condenser fans for heating to maintain setback temperature**.

c. Switch reversing valve for heating or cooling mode on air-to-air heat pump.

7. Hot-Gas Reheat-Coil Operation:

a. Occupied Periods: Humidistat opens hot-gas valve to provide hot-gas reheat, and cycles compressor.

b. Unoccupied Periods: Reheat not required.

8. Gas Furnace Operation:

a. Occupied Periods: **Cycle** burner to maintain **room** temperature.

b. Unoccupied Periods: Cycle burner to maintain setback temperature.

9. Fixed Minimum Outdoor-Air Damper Operation:

a. Occupied Periods: Open to **25** percent.

b. Unoccupied Periods: Close the outdoor-air damper.

10. Economizer Outdoor-Air Damper Operation:

a. Occupied Periods: Open to **10** percent fixed minimum intake, and maximum 100 percent of the fan capacity to comply with ASHRAE Cycle II. Controller shall permit air-side economizer operation when outdoor air is less than **60 deg F (15 deg C)**] . Use **outdoor-air temperature and select between outdoor-air and return-air enthalpy** to adjust mixing dampers. **Start relief-air fan with end switch on outdoor-air damper.** During economizer cycle operation, lock out cooling.

b. Unoccupied Periods: Close outdoor-air damper and open return-air damper.

11. Carbon Dioxide Sensor Operation:

a. Occupied Periods: Reset minimum outdoor-air ratio down to minimum **10** percent to maintain maximum **1000-ppm**] concentration.

b. Unoccupied Periods: Close outdoor-air damper and open return-air damper.

D. Interface Requirements for HVAC Instrumentation and Control System:

1. Interface relay for scheduled operation.
2. Interface relay to provide indication of fault at the central workstation and diagnostic code storage.
3. Provide **BACnet or LonWorks** compatible interface for central HVAC control workstation for the following:

a. Adjusting set points.

b. Monitoring supply fan start, stop, and operation.

c. Inquiring data to include **outdoor-air damper position,** supply and room-air temperature **and humidity**.

d. Monitoring occupied and unoccupied operations.

4. Interface relay to lock out compressor when operating power from the emergency generator.

2.11 ACCESSORIES

A. Duplex, 115-V, ground-fault-interrupter outlet with 15-A overcurrent protection. Include transformer if required. **Outlet shall be energized even if the unit main disconnect is open.**

B. Low-ambient kit using **staged** condenser fans for operation down to **35 deg F (1.7 deg C)**.

C. Filter differential pressure switch with sensor tubing on either side of filter. Set for final filter pressure loss.

D. Coil guards of painted, galvanized-steel wire.

2.12 ROOF CURBSRetain one of first two paragraphs and associated subparagraphs below. Retain first for curbs with vibration isolation and seismic or wind restraints; retain second for curbs provided by RTU manufacturer without vibration isolation and seismic or wind restraints.

A. Roof curbs provided with the roof top unit by the manufacturer with appropriate provisions for connection to the building structure

B. Materials: Galvanized steel with corrosion-protection coating, watertight gaskets, and factory-installed wood nailer; complying with NRCA standards.

1. Curb Insulation and Adhesive: Comply with NFPA 90A or NFPA 90B.

a. Materials: ASTM C 1071, Type I or II.
b. Thickness: **2 inches (50 mm**.

2. Application: Factory applied with adhesive and mechanical fasteners to the internal surface of curb.

a. Liner Adhesive: Comply with ASTM C 916, Type I.
b. Mechanical Fasteners: Galvanized steel, suitable for adhesive attachment, mechanical attachment, or welding attachment to duct without damaging liner when applied as recommended by manufacturer and without causing leakage in cabinet.
c. Liner materials applied in this location shall have air-stream surface coated with a temperature-resistant coating or faced with a plain or coated fibrous mat or fabric depending on service air velocity.
d. Liner Adhesive: Comply with ASTM C 916, Type I.

C. Curb Height: **14 inches (355 mm)**.

D. Wind and Seismic Restraints: Metal brackets compatible with the curb and casing, painted to match RTU, used to anchor unit to the curb, and designed for loads at Project site. Comply with requirements in Division 15 Section "Vibration and Seismic Controls for HVAC Piping and Equipment" for wind-load requirements.

2.13 CAPACITIES AND CHARACTERISTICS

A. Supply-Air Fan:

1. Airflow: As shown on the drawings
2. External Static Pressure: As shown on the drawings**)**>.

3. Fan Speed: As shown on the drawings
4. Motor Horsepower: As shown on the drawings. .
5. Motor Speed: As shown on the drawings..

B. Supply-Air Refrigerant Coil:

1. Total Cooling Capacity: As shown on the drawings
2. Sensible Cooling Capacity: As shown on the drawings Coating: **Baked phenolic**].

C. Compressors:
1. Power Input: As shown on the drawings
2. Seasonal Energy-Efficiency Ratio (SEER): 14.5 minimum .

D. Gas Furnace:

1. Airflow: As shown on the drawings
2. Minimum Thermal Efficiency: 82 percent.

E. Recirculating-Air Filters:

1. Minimum Face Area: 3.5 **sq. ft. (sq. m)**.
2. Thickness: **2 inches (50 mm)**.

F. Outdoor-Air Filters:

1. Minimum Face Area: <**Insert sq. ft. (sq. m)**>.
2. Thickness: **2 inches (50 mm)**
3. Initial Resistance: <**Insert inches wg (kPa)**>.
4. Final Resistance: <**Insert inches wg (kPa)**>.

G. Electrical Characteristics for Single-Point Connection:

1. Voltage: 480
2. Phase: **277**.
3. Hertz: 60.
4. Full-Load Amperes: As shown on the drawing.
5. Minimum Circuit Ampacity: As shown on the drawing.
6. Maximum Overcurrent Protection: AS shown on the drawings.

H. Sound Power: Radiated from condenser casing.

1. 63 Hz - 79 dB
2. 250 Hz - 79 dB.
3. 500 Hz - 79 dB.
4. 1 kHz - 77 dB.
5. 2 kHz - 71 dB.
6. 4 Hz - 67 dB.
7. 8 Hz - 58 dB.

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 RTUs.

B. Examine roughing-in for RTUs to verify actual locations of piping and duct connections before equipment installation.

C. Examine roofs for suitable conditions where RTUs will be installed.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Roof Curb: Install on roof structure , level and secure, according to **NRCA's "Low-Slope Membrane Roofing Construction Details Manual," Illustration "Raised Curb Detail for Rooftop Air Handling Units and Ducts."** Install RTUs on curbs and coordinate roof penetrations and flashing with roof construction specified in Division 7 Section "Roof Accessories." Secure RTUs to upper curb rail, and secure curb base to roof framing or concrete base with anchor bolts. Coordinate with the roofing contractor

B. Unit Support: Install unit level on structural **curbs**. Coordinate wall penetrations and flashing with wall construction. Secure RTUs to structural support with anchor bolts.

C. Install wind and seismic restraints according to manufacturer's written instructions

3.3 CONNECTIONS

A. Install condensate drain, minimum connection size, with trap and indirect connection to nearest roof drain or area drain.

B. Install piping adjacent to RTUs to allow service and maintenance.

1. Gas Piping: Comply with applicable requirements in Division 15 Section "Fuel Gas Piping." Connect gas piping to burner, full size of gas train inlet, and connect with union and shutoff valve with sufficient clearance for burner removal and service.

C. Duct installation requirements are specified in other Division 15 Sections. Drawings indicate the general arrangement of ducts. The following are specific connection requirements:

1. Install ducts to termination at top of roof curb.
2. Remove roof decking only as required for passage of ducts. Do not cut out decking under entire roof curb.
3. Connect supply ducts to RTUs with flexible duct connectors specified in Division 15 Section "Duct Accessories."
4. Install return-air duct continuously through roof structure.

3.4 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections. Report results in writing.

B. Perform tests and inspections and prepare test reports.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing. Report results in writing.

C. Tests and Inspections:

1. After installing RTUs and after electrical circuitry has been energized, test units for compliance with requirements.
2. Inspect for and remove shipping bolts, blocks, and tie-down straps.
3. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

D. Remove and replace malfunctioning units and retest as specified above.

3.5 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

B. Complete installation and startup checks according to manufacturer's written instructions and do the following:

1. Inspect for visible damage to unit casing.
2. Inspect for visible damage to furnace combustion chamber.
3. Inspect for visible damage to compressor, coils, and fans.
4. Inspect internal insulation.
5. Verify that labels are clearly visible.
6. Verify that clearances have been provided for servicing.
7. Verify that controls are connected and operable.
8. Verify that filters are installed.
9. Clean condenser coil and inspect for construction debris.
10. Clean furnace flue and inspect for construction debris.
11. Connect and purge gas line.
12. Remove packing from vibration isolators.
13. Inspect operation of barometric relief dampers.
14. Verify lubrication on fan and motor bearings.
15. Inspect fan-wheel rotation for movement in correct direction without vibration and binding.
16. Adjust fan belts to proper alignment and tension.
17. Start unit according to manufacturer's written instructions.

    a. Start refrigeration system.
    b. Do not operate below recommended low-ambient temperature.
    c. Complete startup sheets and attach copy with Contractor's startup report.

18. Inspect and record performance of interlocks and protective devices; verify sequences.

19. Operate unit for an initial period as recommended or required by manufacturer.
20. Perform the following operations for both minimum and maximum firing. Adjust burner for peak efficiency.

    a. Measure gas pressure on manifold.
    b. Inspect operation of power vents.
    c. Measure combustion-air temperature at inlet to combustion chamber.
    d. Measure flue-gas temperature at furnace discharge.
    e. Perform flue-gas analysis. Measure and record flue-gas carbon dioxide and oxygen concentration.
    f. Measure supply-air temperature and volume when burner is at maximum firing rate and when burner is off. Calculate useful heat to supply air.

21. Calibrate thermostats.
22. Adjust and inspect high-temperature limits.
23. Inspect outdoor-air dampers for proper stroke and interlock with return-air dampers.
24. Start refrigeration system and measure and record the following when ambient is a minimum of 15 deg F (8 deg C) above return-air temperature:

    a. Coil leaving-air, dry- and wet-bulb temperatures.
    b. Coil entering-air, dry- and wet-bulb temperatures.
    c. Outdoor-air, dry-bulb temperature.
    d. Outdoor-air-coil, discharge-air, dry-bulb temperature.

25. Inspect controls for correct sequencing of heating, mixing dampers, refrigeration, and normal and emergency shutdown.
26. Measure and record the following minimum and maximum airflows. Plot fan volumes on fan curve.

    a. Supply-air volume.
    b. Return-air volume.
    c. Relief-air volume.
    d. Outdoor-air intake volume.

27. Simulate maximum cooling demand and inspect the following:

    a. Compressor refrigerant suction and hot-gas pressures.
    b. Short circuiting of air through condenser coil or from condenser fans to outdoor-air intake.

28. Verify operation of remote panel including pilot-light operation and failure modes. Inspect the following:

    a. High-temperature limit on gas-fired heat exchanger.
    b. Low-temperature safety operation.
    c. Filter high-pressure differential alarm.
    d. Economizer to minimum outdoor-air changeover.
    e. Relief-air fan operation.
    f. Smoke alarms.

29. After startup and performance testing and prior to Substantial Completion, replace existing filters with new filters.

3.6 CLEANING AND ADJUSTING

A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to **two** visits to site during other-than-normal occupancy hours for this purpose.

B. After completing system installation and testing, adjusting, and balancing RTU and air-distribution systems, clean filter housings and install new filters.

3.7 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain RTUs. Refer to Division 1 Section "Demonstration and Training."

END OF SECTION 15732

METAL DUCTS

DIVISION 15 SECTION 15815

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. Section Includes:

1. Single-wall rectangular ducts and fittings.
2. Sheet metal materials.
3. Duct liner.
4. Sealants and gaskets.
5. Hangers and supports.
6. Seismic-restraint devices.

B. Related Sections:
1. Division 15 Section with "HVAC Casings" for factory- and field-fabricated casings for mechanical equipment.
2. Division 15 Section with "Duct Accessories" for dampers, sound-control devices, duct-mounting access doors and panels, turning vanes, and flexible ducts.
3. Division 15 Section with "Testing, Adjusting, and Balancing" for testing, adjusting, and balancing requirements for metal ducts.

1.3 PERFORMANCE REQUIREMENTS

A. Delegated Duct Design: Duct construction, including sheet metal thicknesses, seam and joint construction, reinforcements, and hangers and supports, shall comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" and performance requirements and design criteria indicated in "Duct Schedule" Article.

B. Structural Performance: Duct hangers and supports **and seismic restraints** shall withstand the effects of gravity **and seismic** loads and stresses within limits and under conditions described in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" **and ASCE/SEI 7**

1. Seismic Hazard Level A: Seismic force to weight ratio, 0.48.
2. Seismic Hazard Level B: Seismic force to weight ratio, 0.30.
3. Seismic Hazard Level C: Seismic force to weight ratio, 0.15.

C. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1-2004.

1.4 SUBMITTALS

A. Product Data: For each type of the following products:

1. Liners and adhesives.
2. Sealants and gaskets.
3. Seismic-restraint devices.

B. Shop Drawings:

1. Fabrication, assembly, and installation, including plans, elevations, sections, components, and attachments to other work.
2. Factory- and shop-fabricated ducts and fittings.
3. Duct layout indicating sizes, configuration, liner material, and static-pressure classes.
4. Elevation of top of ducts.
5. Dimensions of main duct runs from building grid lines.
6. Fittings.
7. Reinforcement and spacing.
8. Seam and joint construction.
9. Penetrations through fire-rated and other partitions.
10. Equipment installation based on equipment being used on Project.
11. Locations for duct accessories, including dampers, turning vanes, and access doors and panels.
12. Hangers and supports, including methods for duct and building attachment and vibration isolation.
13. Show coordination with other trades**.**

C. Delegated-Design Submittal:

1. Sheet metal thicknesses.
2. Joint and seam construction and sealing.
3. Reinforcement details and spacing.
4. Materials, fabrication, assembly, and spacing of hangers and supports.

D. Coordination Drawings: Plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Duct installation in congested spaces, indicating coordination with general construction, building components, and other building services. Indicate proposed changes to duct layout.
2. Suspended ceiling components.
3. Structural members to which duct will be attached.
4. Size and location of initial access modules for acoustical tile.
5. Penetrations of smoke barriers and fire-rated construction.
6. Items penetrating finished ceiling including the following:

    a. Lighting fixtures.
    b. Air outlets and inlets.
    c. Speakers.
    d. Sprinklers.
    e. Access panels.
    f. Perimeter moldings.

F. UL Certificate for fabricating shop

G. Welding certificates.

H. Burn Permits and welding permits

I. Field quality-control reports.

1.5 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to [**AWS D1.1/D1.1M, "Structural Welding Code - Steel," for hangers and supports.**] [**AWS D1.2/D1.2M, "Structural Welding Code - Aluminum," for aluminum supports.**] [**AWS D9.1M/D9.1, "Sheet Metal Welding Code," for duct joint and seam welding.**]

B. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel," for hangers and supports.
2. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum," for aluminum supports.
3. AWS D9.1M/D9.1, "Sheet Metal Welding Code," for duct joint and seam welding.

C. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1-2004, Section 5 - "Systems and Equipment" and Section 7 - "Construction and System Start-Up."

D. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1-2004, Section 6.4.4 - "HVAC System Construction and Insulation."

PART 2 - PRODUCTS

2.1 SINGLE-WALL RECTANGULAR DUCTS AND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.

B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 1-4, "Transverse (Girth) Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 1-5, "Longitudinal Seams - Rectangular Ducts," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

D. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 2, "Fittings and Other Construction," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

E. Provide turning vanes in all “Tees” and duct elbows greater than 45° comply with all relevant SMACNA requirements.

2.2 SHEET METAL MATERIALS

A. General Material Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.

1. Galvanized Coating Designation: **G60 (Z180)**.
2. Finishes for Surfaces Exposed to View: Mill phosphatized.

3. Galvanized Coating Designation: **G60 (Z180)**.
4. Minimum Thickness for Factory-Applied PVC Coating: 4 mils (0.10 mm) thick[**on sheet metal surface of ducts and fittings exposed to corrosive conditions, and minimum 1 mil (0.025 mm) thick on opposite surface**].
5. Coating Materials: Acceptable to authorities having jurisdiction for use on ducts listed and labeled by an NRTL for compliance with UL 181, Class 1.

C. Carbon-Steel Sheets: Comply with ASTM A 1008/A 1008M, with oiled, matte finish for exposed ducts.

D. Factory- or Shop-Applied Antimicrobial Coating:

1. Apply to the surface of sheet metal that will form the interior surface of the duct. An untreated clear coating shall be applied to the exterior surface.
2. Antimicrobial compound shall be tested for efficacy by an NRTL and registered by the EPA for use in HVAC systems.
3. Coating containing the antimicrobial compound shall have a hardness of 2H, minimum, when tested according to ASTM D 3363.
4. Surface-Burning Characteristics: Maximum flame-spread index of 25 and maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.
5. Shop-Applied Coating Color: **White**.
6. Antimicrobial coating on sheet metal is not required for duct containing liner treated with antimicrobial coating.

E. Tie Rods: Galvanized steel, 1/4-inch (6-mm) minimum diameter for lengths 36 inches (900 mm) or less; 3/8-inch (10-mm) minimum diameter for lengths longer than 36 inches (900 mm).

2.3 SEALANT AND GASKETS

A. General Sealant and Gasket Requirements: Surface-burning characteristics for sealants and gaskets shall be a maximum flame-spread index of 25 and a maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.

B. Two-Part Tape Sealing System:

1. Tape: Woven cotton fiber impregnated with mineral gypsum and modified acrylic/silicone activator to react exothermically with tape to form hard, durable, airtight seal.
2. Tape Width: **3 inches (76 mm)**.
3. Sealant: Modified styrene acrylic.
4. Water resistant.
5. Mold and mildew resistant.

6. Maximum Static-Pressure Class: 10-inch wg (2500 Pa), positive and negative.
7. Service: Indoor and outdoor.
8. Service Temperature: Minus 40 to plus 200 deg F (Minus 40 to plus 93 deg C).
9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum.
10. For indoor applications, use sealant that has a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

C. Water-Based Joint and Seam Sealant:

1. Application Method: Brush on.
2. Solids Content: Minimum 65 percent.
3. Shore A Hardness: Minimum 20.
4. Water resistant.
5. Mold and mildew resistant.
6. VOC: Maximum 75 g/L (less water).
7. Maximum Static-Pressure Class: 10-inch wg (2500 Pa), positive and negative.
8. Service: Indoor or outdoor.
9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.

D. Solvent-Based Joint and Seam Sealant:

1. Application Method: Brush on.
2. Base: Synthetic rubber resin.
3. Solvent: Toluene and heptane.
4. Solids Content: Minimum 60 percent.
5. Shore A Hardness: Minimum 60.
6. Water resistant.
7. Mold and mildew resistant.
8. For indoor applications, use sealant that has a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
9. Maximum Static-Pressure Class: 10-inch wg (2500 Pa), positive or negative.
10. Service: Indoor or outdoor.
11. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.

E. Flanged Joint Sealant: Comply with ASTM C 920.

1. General: Single-component, acid-curing, silicone, elastomeric.
2. Type: S.
3. Grade: NS.
4. Class: 25.
5. Use: O.
6. For indoor applications, use sealant that has a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

F. Flange Gaskets: Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer.

2.4 HANGERS AND SUPPORTS

A. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts.

B. Hanger Rods for Corrosive Environments: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.

C. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 4-1 (Table 4-1M), "Rectangular Duct Hangers Minimum Size," and Table 4-2, "Minimum Hanger Sizes for Round Duct."

D. Steel Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A 603.

E. Steel Cables for Stainless-Steel Ducts: Stainless steel complying with ASTM A 492.

F. Steel Cable End Connections: Cadmium-plated steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.

G. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.

H. Trapeze and Riser Supports:

1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.
2. Supports for Stainless-Steel Ducts: Stainless-steel shapes and plates.
3. Supports for Aluminum Ducts: Aluminum or galvanized steel coated with zinc chromate.

2.5 SEISMIC-RESTRAINT DEVICES

A. Manufacturers: Subject to compliance with requirements, **Available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following**]:

1. Cooper B-Line, Inc.; a division of Cooper Industries.
2. Ductmate Industries, Inc.
3. Hilti Corp.
4. Kinetics Noise Control.
5. Loos & Co.; Cableware Division.
6. Mason Industries.
7. TOLCO; a brand of NIBCO INC.
8. Unistrut Corporation; Tyco International, Ltd.

B. General Requirements for Restraint Components: Rated strengths, features, and applications shall be as defined in reports by **an agency acceptable to authorities having jurisdiction**.

1. Structural Safety Factor: Allowable strength in tension, shear, and pullout force of components shall be at least **four** times the maximum seismic forces to which they will be subjected.

C. Channel Support System: Shop- or field-fabricated support assembly made of slotted steel channels rated in tension, compression, and torsion forces and with accessories for attachment to braced component at one end and to building structure at the other end. Include matching components and corrosion-resistant coating.

D. Restraint Cables: **ASTM A 603, galvanized**-steel cables with end connections made of cadmium-plated steel assemblies with brackets, swivel, and bolts designed for restraining cable service; and with an automatic-locking and clamping device or double-cable clips.

E. Hanger Rod Stiffener: **Steel tube or steel slotted-support-system sleeve with internally bolted connections** to hanger rod.

F. Mechanical Anchor Bolts: Drilled-in and stud-wedge or female-wedge type. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488.

PART 3 - EXECUTION

3.1 DUCT INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of duct system. Indicated duct locations, configurations, and arrangements were used to size ducts and calculate friction loss for air-handling equipment sizing and for other design considerations. Install duct systems as indicated unless deviations to layout are approved on Shop Drawings and Coordination Drawings.

B. Install ducts according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" unless otherwise indicated.

C. Install round[**and flat-oval**] ducts in maximum practical lengths.

D. Install ducts with fewest possible joints.

E. Install factory- or shop-fabricated fittings for changes in direction, size, and shape and for branch connections.

F. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.

G. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.

H. Install ducts with a clearance of 1 inch (25 mm), plus allowance for insulation thickness.

I. Route ducts to avoid passing through transformer vaults and electrical equipment rooms and enclosures.

J. Where ducts pass through non-fire-rated interior partitions and exterior walls and are exposed to view, cover the opening between the partition and duct or duct insulation with sheet metal flanges of same metal thickness as the duct. Overlap openings on four sides by at least 1-1/2 inches (38 mm).

K. Where ducts pass through fire-rated interior partitions and exterior walls, install fire dampers. Comply with requirements in Division 15 Section "Duct Accessories" for fire and smoke dampers.

L. Protect duct interiors from moisture, construction debris and dust, and other foreign materials. **Comply with SMACNA's "Duct Cleanliness for New Construction Guidelines."**

3.2 DUCT SEALING

A. Seal ducts for duct static-pressure, seal classes, and leakage classes specified in "Duct Schedule" Article according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

3.3 HANGER AND SUPPORT INSTALLATION

A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 4, "Hangers and Supports."

B. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.

1. Where practical, install concrete inserts before placing concrete.
2. Install powder-actuated concrete fasteners after concrete is placed and completely cured.
3. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches (100 mm) thick.
4. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches (100 mm) thick.
5. Do not use powder-actuated concrete fasteners for seismic restraints.

C. Hanger Spacing: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 4-1 (Table 4-1M), "Rectangular Duct Hangers Minimum Size," and Table 4-2, "Minimum Hanger Sizes for Round Duct," for maximum hanger spacing; install hangers and supports within 24 inches (610 mm) of each elbow and within 48 inches (1200 mm) of each branch intersection.

D. Hangers Exposed to View: Threaded rod and angle or channel supports.

E. Support vertical ducts with steel angles or channel secured to the sides of the duct with welds, bolts, sheet metal screws, or blind rivets; support at each floor and at a maximum intervals of 16 feet (5 m).

F. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

3.4 SEISMIC-RESTRAINT-DEVICE INSTALLATION

A. Install ducts with hangers and braces designed to support the duct and to restrain against seismic forces required by applicable building codes. Comply with **SMACNA's "Seismic Restraint Manual: Guidelines for Mechanical Systems."**

1. Space lateral supports a maximum of **40 feet (12 m)** o.c., and longitudinal supports a maximum of **80 feet (24 m)** o.c.
2. Brace a change of direction longer than 12 feet (3.7 m).

B. Select seismic-restraint devices with capacities adequate to carry present and future static and seismic loads.

C. Install cables so they do not bend across edges of adjacent equipment or building structure.

D. Install cable restraints on ducts that are suspended with vibration isolators.

E. Install seismic-restraint devices using methods approved by [**an evaluation service member of the ICC Evaluation Service**] [**the Office of Statewide Health Planning and Development for the State of California**] [**an agency acceptable to authorities having jurisdiction**].

F. Attachment to Structure: If specific attachment is not indicated, anchor bracing and restraints to structure, to flanges of beams, to upper truss chords of bar joists, or to concrete members.

G. Drilling for and Setting Anchors:

1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcement or embedded items during drilling. Notify the Architect if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid pre stressed tendons, electrical and telecommunications conduit, and gas lines.
2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
3. Wedge Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.
4. Set anchors to manufacturer's recommended torque, using a torque wrench.
5. Install zinc-coated steel anchors for interior applications and stainless-steel anchors for applications exposed to weather.

3.5 CONNECTIONS

A. Make connections to equipment with flexible connectors complying with Division 15 Section "Duct Accessories."

B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

3.6 PAINTING

A. Paint interior of metal ducts that are visible through registers and grilles and that do not have duct liner. Apply one coat of flat, black, latex paint over a compatible galvanized-steel primer. Paint materials and application requirements are specified in Division 9 painting Sections.

3.7 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Leakage Tests:

1. Comply with SMACNA's "HVAC Air Duct Leakage Test Manual." Submit a test report for each test.
2. Test the following systems:
   a. Supply Ducts with a Pressure Class of **2-Inch wg (500 Pa)** or Higher: Test representative duct sections totaling no less than **50** percent of total installed duct area for each designated pressure class.

b. Return Ducts with a Pressure Class of **2-Inch wg (500 Pa)** or Higher: Test representative duct sections**,** totaling no less than **50** percent of total installed duct area for each designated pressure class.

3. Disassemble, reassemble, and seal segments of systems to accommodate leakage testing and for compliance with test requirements.
4. Test for leaks before applying external insulation.
5. Conduct tests at static pressures equal to maximum design pressure of system or section being tested. If static-pressure classes are not indicated, test system at maximum system design pressure. Do not pressurize systems above maximum design operating pressure.
6. Give **seven** days' advance notice for testing.

C. Duct System Cleanliness Tests:

1. Visually inspect duct system to ensure that no visible contaminants are present.
2. Test sections of metal duct system, chosen randomly by Owner, for cleanliness according to "Vacuum Test" in NADCA ACR, "Assessment, Cleaning and Restoration of HVAC Systems."

a. Acceptable Cleanliness Level: Net weight of debris collected on the filter media shall not exceed 0.75 mg/100 sq. cm.

D. Duct system will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

3.8 DUCT CLEANING

A. Clean **new and existing** duct system(s) before testing, adjusting, and balancing.

B. Use service openings for entry and inspection.

1. Create new openings and install access panels appropriate for duct static-pressure class if required for cleaning access. Provide insulated panels for insulated or lined duct. Patch insulation and liner as recommended by duct liner manufacturer. Comply with Division 15 Section "Duct Accessories" for access panels and doors.
2. Disconnect and reconnect flexible ducts as needed for cleaning and inspection.
3. Remove and reinstall ceiling to gain access during the cleaning process.

C. Particulate Collection and Odor Control:

1. When venting vacuuming system inside the building, use HEPA filtration with 99.97 percent collection efficiency for 0.3-micron-size (or larger) particles.
2. When venting vacuuming system to outdoors, use filter to collect debris removed from HVAC system, and locate exhaust downwind and away from air intakes and other points of entry into building.

D. Clean the following components by removing surface contaminants and deposits:

1. Air outlets and inlets (registers, grilles, and diffusers).

2. Supply, return, and exhaust fans including fan housings, plenums (except ceiling supply and return plenums), scrolls, blades or vanes, shafts, baffles, dampers, and drive assemblies.
3. Air-handling unit internal surfaces and components including mixing box, coil section, air wash systems, spray eliminators, condensate drain pans, humidifiers and dehumidifiers, filters and filter sections, and condensate collectors and drains.
4. Coils and related components.
5. Return-air ducts, dampers, actuators, and turning vanes except in ceiling plenums and mechanical equipment rooms.
6. Supply-air ducts, dampers, actuators, and turning vanes.
7. Dedicated exhaust and ventilation components and makeup air systems.

E. Mechanical Cleaning Methodology:

1. Clean metal duct systems using mechanical cleaning methods that extract contaminants from within duct systems and remove contaminants from building.
2. Use vacuum-collection devices that are operated continuously during cleaning. Connect vacuum device to downstream end of duct sections so areas being cleaned are under negative pressure.
3. Use mechanical agitation to dislodge debris adhered to interior duct surfaces without damaging integrity of metal ducts, duct liner, or duct accessories.
4. Clean fibrous-glass duct liner with HEPA vacuuming equipment; do not permit duct liner to get wet. Replace fibrous-glass duct liner that is damaged, deteriorated, or delaminated or that has friable material, mold, or fungus growth.
5. Clean coils and coil drain pans according to NADCA 1992. Keep drain pan operational. Rinse coils with clean water to remove latent residues and cleaning materials; comb and straighten fins.
6. Provide drainage and cleanup for wash-down procedures.
7. Antimicrobial Agents and Coatings: Apply EPA-registered antimicrobial agents if fungus is present. Apply antimicrobial agents according to manufacturer's written instructions after removal of surface deposits and debris.

3.9 START UP

A. Air Balance: Comply with requirements in Division 15 Section "Testing, Adjusting, and Balancing."

3.10 DUCT SCHEDULE

A. Fabricate ducts with galvanized sheet steel except as otherwise indicated and as follows:

B. Supply Ducts:

1. Ducts Connected to Fan Coil Units, Furnaces, Heat Pumps, and Terminal Units:

a. Pressure Class: Positive **-inch wg (250 Pa) 2-inch wg (500 Pa)**.
b. Minimum SMACNA Seal Class: **A**.
c. SMACNA Leakage Class for Rectangular: **12**.
d. SMACNA Leakage Class for Round and Flat Oval: **12**.

C. Return Ducts:

1. Ducts Connected to Fan Coil Units, Furnaces, Heat Pumps, and Terminal Units <**Insert equipment**>:

    a. Pressure Class: Positive or negative **1-inch wg (250 Pa)**.
    b. Minimum SMACNA Seal Class: **A**
    c. SMACNA Leakage Class for Rectangular: **12**
    d. SMACNA Leakage Class for Round and Flat Oval: **12** .

2. Ducts Connected to Air-Handling Units :

    a. Pressure Class: Positive or negative **2-inch wg (500 Pa)**.
    b. Minimum SMACNA Seal Class: **A**.
    c. SMACNA Leakage Class for Rectangular: **6**
    d. SMACNA Leakage Class for Round and Flat Oval: **6**.

D. Exhaust Ducts:

1. Ducts Connected to Fans Exhausting (ASHRAE 62.1, Class 1 and 2) Air:

    a. Pressure Class: Negative **1-inch wg (250 Pa)**.
    b. Minimum SMACNA Seal Class: **A** if negative pressure, and A if positive pressure.
    c. SMACNA Leakage Class for Rectangular: **12**
    d. SMACNA Leakage Class for Round and Flat Oval: **6**

2. Ducts Connected to Air-Handling Units :

    a. Pressure Class: Positive or negative **2-inch wg (500 Pa)** .
    b. Minimum SMACNA Seal Class: **A** if negative pressure, and A if positive pressure.
    c. SMACNA Leakage Class for Rectangular: **6**.

3. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Elbows."

    a. Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
    b. Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.
    c. Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-3, "Vanes and Vane Runners," and Figure 2-4, "Vane Support in Elbows."

4. Round Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-3, "Round Duct Elbows."

    a. Minimum Radius-to-Diameter Ratio and Elbow Segments: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 3-1, "Mitered Elbows." Elbows with less than 90-degree change of direction have proportionately fewer segments.

        1) Velocity 1000 fpm (5 m/s) or Lower: 0.5 radius-to-diameter ratio and three segments for 90-degree elbow.
        2) Velocity 1000 to 1500 fpm (5 to 7.6 m/s): 1.0 radius-to-diameter ratio and four segments for 90-degree elbow.
        3) Velocity 1500 fpm (7.6 m/s) or Higher: 1.5 radius-to-diameter ratio and five segments for 90-degree elbow.
        4) Radius-to Diameter Ratio: 1.5.

b. Round Elbows, **12 Inches (305 mm)** and Smaller in Diameter: Stamped or pleated.
c. Round Elbows, **14 Inches (356 mm)** and Larger in Diameter: **Standing seam** .

E. Branch Configuration:

1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-6, "Branch Connections."

   a. Rectangular Main to Rectangular Branch: 45-degree entry.
   b. Rectangular Main to Round Branch: Spin in.

2. Round and Flat Oval: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "90 Degree Tees and Laterals," and Figure 3-5, "Conical Tees." Saddle taps are permitted in existing duct.

   a. Velocity 1000 fpm (5 m/s) or Lower: 90-degree tap.
   b. Velocity 1000 to 1500 fpm (5 to 7.6 m/s): Conical tap.
   c. Velocity 1500 fpm (7.6 m/s) or Higher: 45-degree lateral.

END OF SECTION 15815

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. Section Includes:

1. Backdraft and pressure relief dampers.
2. Barometric relief dampers.
3. Manual volume dampers.
4. Control dampers.
5. Fire dampers.
6. Ceiling dampers.
7. Smoke dampers.
8. Combination fire and smoke dampers.
9. Flange connectors.
10. Turning vanes.
11. Duct-mounted access doors.
12. Flexible connectors.
13. Flexible ducts.
14. Duct accessory hardware.

B. Related Sections:

1. "Fire Alarm" for duct-mounted fire and smoke detectors.
2. "Intake and Relief Ventilators" for roof-mounted ventilator caps.

1.3 SUBMITTALS

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

1. For duct silencers, include pressure drop and dynamic insertion loss data. Include breakout noise calculations for high transmission loss casings.

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

1. Detail duct accessories fabrication and installation in ducts and other construction. Include dimensions, weights, loads, and required clearances; and method of field assembly into duct systems and other construction. Include the following:

a. Special fittings.
b. Manual volume damper installations.
c. Control damper installations.

d. Fire-damper, smoke-damper, combination fire and smoke-damper, ceiling, and corridor damper installations, including sleeves; and duct-mounted access doors and remote damper operators.
e. Duct security bars.
f. Wiring Diagrams: For power, signal, and control wiring.

C. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which ceiling-mounted access panels and access doors required for access to duct accessories are shown and coordinated with each other, using input from Installers of the items involved.

D. Source quality-control reports.

E. Operation and Maintenance Data: For air duct accessories to include in operation and maintenance manuals.

1.4 QUALITY ASSURANCE

A. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," and with NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."

B. Comply with AMCA 500-D testing for damper rating.

1.5 EXTRA MATERIALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Fusible Links: Furnish quantity equal to [**10**] <**Insert number**> percent of amount installed.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.

1. Galvanized Coating Designation: **G60 (Z180)**] [**G90 (Z275)**.
2. Exposed-Surface Finish: Mill phosphatized.

C. Extruded Aluminum: Comply with ASTM B 221 (ASTM B 221M), Alloy 6063, Temper T6.

D. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.

E. Tie Rods: Galvanized steel, 1/4-inch (6-mm) minimum diameter for lengths 36 inches (900 mm) or less; 3/8-inch (10-mm) minimum diameter for lengths longer than 36 inches (900 mm).

2.2 BACKDRAFT AND PRESSURE RELIEF DAMPERS

A. Manufacturers: Subject to compliance with requirements, **available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following**:

1. Air Balance Inc.; a division of Mestek, Inc.
2. American Warming and Ventilating; a division of Mestek, Inc.
3. Cesco Products; a division of Mestek, Inc.
4. Duro Dyne Inc.
5. Greenheck Fan Corporation.
6. Lloyd Industries, Inc.
7. Nailor Industries Inc.
8. NCA Manufacturing, Inc.
9. Pottorff; a division of PCI Industries, Inc.
10. Ruskin Company.
11. SEMCO Incorporated.
12. Vent Products Company, Inc.

B. Description: Gravity balanced.

C. Maximum Air Velocity: **2000 fpm (10 m/s)**.

D. Maximum System Pressure: **1-inch wg (0.25 kPa)**.

E. Frame: **0.052-inch- (1.3-mm-) thick, galvanized sheet steel**, with welded corners **and mounting flange**.

F. Blades: Multiple single-piece blades,[c**enter-pivoted,** maximum 6-inch (150-mm) width, **0.025-inch- (0.6-mm- thick, roll-formed aluminum** [**0.050-inch- (1.2-mm-) thick aluminum sheet** with sealed edges.

G. Blade Action: Parallel.

H. Blade Seals: **Felt**.

I. Blade Axles:

1. Material: **Nonferrous metal**.
2. Diameter: **0.20 inch (5 mm)**.

J. Tie Bars and Brackets: **Galvanized steel**.

K. Return Spring: Adjustable tension.

L. Bearings: **Steel ball**.

M. Accessories:

1. Adjustment device to permit setting for varying differential static pressure.

2. Counterweights and spring-assist kits for vertical airflow installations.
3. Electric actuators.
4. Chain pulls.
5. Screen Mounting: Front mounted in sleeve.

    a. Sleeve Thickness: 20-gage (1.0-mm) minimum.
    b. Sleeve Length: 6 inches (152 mm) minimum.
6. Screen Material: **Galvanized steel**.
7. Screen Type: **Bird**.
8. 90-degree stops.

2.3 BAROMETRIC RELIEF DAMPERS

A. Manufacturers: Subject to compliance with requirements, **available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following**:

1. Air Balance Inc.; a division of Mestek, Inc.
2. American Warming and Ventilating; a division of Mestek, Inc.
3. Cesco Products; a division of Mestek, Inc.
4. Duro Dyne Inc.
5. Greenheck Fan Corporation.
6. Lloyd Industries, Inc.
7. Nailor Industries Inc.
8. NCA Manufacturing, Inc.
9. Pottorff; a division of PCI Industries, Inc.
10. Ruskin Company.
11. SEMCO Incorporated.
12. Vent Products Company, Inc.

B. Suitable for horizontal or vertical mounting.

C. Maximum Air Velocity: **2000 fpm (10 m/s)**.

D. Maximum System Pressure: 2-inch wg (0.5 kPa) .

E. Frame: **0.064-inch- (1.6-mm-) thick, galvanized sheet steel 0.063-inch- (1.6-mm-) thick extruded aluminum**, with welded corners **and mounting flange**.

F. Blades:

1. Multiple, **0.025-inch- (0.6-mm-) thick, roll-formed aluminum**.
2. Maximum Width: 6 inches (150 mm).
3. Action: Parallel.
4. Balance: Gravity.
5. Eccentrically pivoted.

G. Blade Seals: **Vinyl**.

H. Blade Axles: **Galvanized steel**.

I. Tie Bars and Brackets:

1. Materia **Galvanized**.
2. Rattle free with 90-degree stop.

J. Return Spring: Adjustable tension.

K. Bearings: **Synthetic**.

L. Accessories:

1. Flange on intake.
2. Adjustment device to permit setting for varying differential static pressures.

2.4 MANUAL VOLUME DAMPERS

A. Standard, Steel, Manual Volume Dampers:

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. Air Balance Inc.; a division of Mestek, Inc.
b. American Warming and Ventilating; a division of Mestek, Inc.
c. Flexmaster U.S.A., Inc.
d. McGill AirFlow LLC.
e. METALAIRE, Inc.
f. Nailor Industries Inc.
g. Pottorff; a division of PCI Industries, Inc.
h. Ruskin Company.
i. Trox USA Inc.
j. Vent Products Company, Inc.

2. Standard leakage rating[**, with linkage outside airstream**].
3. Suitable for horizontal or vertical applications.
4. Frames:

a. Hat-shaped, **galvanized** steel channels, 0.064-inch (1.62-mm) minimum thickness.
b. Mitered and welded corners.
c. Flanges for attaching to walls and flangeless frames for installing in ducts.

5. Blades:

a. Multiple or single blade.
b. Parallel- or opposed-blade design.
c. Stiffen damper blades for stability.
d. [**Galvanized**] [**Stainless**]-steel, 0.064 inch (1.62 mm) thick.

6. Blade Axles: **Galvanized steel**.
7. Bearings:

a. **Oil-impregnated bronze** .
b. Dampers in ducts with pressure classes of 3-inch wg (750 Pa) or less shall have axles full length of damper blades and bearings at both ends of operating shaft.

8. Tie Bars and Brackets: Galvanized steel.

B. Jackshaft:

1. Size: 1-inch (25-mm) diameter.
2. Material: Galvanized-steel pipe rotating within pipe-bearing assembly mounted on supports at each mullion and at each end of multiple-damper assemblies.
3. Length and Number of Mountings: As required to connect linkage of each damper in multiple-damper assembly.

C. Damper Hardware:

1. Zinc-plated, die-cast core with dial and handle made of 3/32-inch- (2.4-mm-) thick zinc-plated steel, and a 3/4-inch (19-mm) hexagon locking nut.
2. Include center hole to suit damper operating-rod size.
3. Include elevated platform for insulated duct mounting.

2.5 CONTROL DAMPERS

A. Manufacturers: Subject to compliance with requirements, **available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following**:
1. Greenheck Fan Corporation.
2. Arrow United Industries; a division of Mestek, Inc.
3. Cesco Products; a division of Mestek, Inc.
4. Duro Dyne Inc.
5. Flexmaster U.S.A., Inc.
6. Lloyd Industries, Inc.
7. M&I Air Systems Engineering; Division of M&I Heat Transfer Products Ltd.
8. McGill AirFlow LLC.
9. METALAIRE, Inc.
10. Metal Form Manufacturing, Inc.
11. Nailor Industries Inc.
12. NCA Manufacturing, Inc.
13. Ruskin Company.
14. Vent Products Company, Inc.
15. Young Regulator Company.

B. Low-leakage rating **with linkage outside airstream,** and bearing AMCA's Certified Ratings Seal for both air performance and air leakage.

C. Frames:

1. Hat shaped.
2. **Galvanized** steel channels, 0.064 inch (1.62 mm) thick.
3. Mitered and welded corners.

D. Blades:

1. Multiple blade with maximum blade width of 4 inches (200 mm).
2. **Parallel** blade design.
3. **Galvanized** steel.
4. 0.064 inch (1.62 mm) thick.

5. Blade Edging: Closed-cell neoprene edging.
6. Blade Edging: Inflatable seal blade edging, or replaceable rubber seals.

E. Blade Axles: 1/2-inch- (13-mm-) diameter; **galvanized steel**; blade-linkage hardware of zinc-plated steel and brass; ends sealed against blade bearings.

1. Operating Temperature Range: From minus 40 to plus 200 degree F (minus 40 to plus 93 deg C).

F. Bearings:

1. **Oil-impregnated bronze** .
2. Dampers in ducts with pressure classes of 3-inch wg (750 Pa) or less shall have axles full length of damper blades and bearings at both ends of operating shaft.
3. Thrust bearings at each end of every blade.

2.6 FIRE DAMPERS

A. Manufacturers: Subject to compliance with requirements, **available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following**:
1. Greenheck Fan Corporation.
2. Air Balance Inc.; a division of Mestek, Inc.
3. Arrow United Industries; a division of Mestek, Inc.
4. Cesco Products; a division of Mestek, Inc.
5. McGill AirFlow LLC.
6. METALAIRE, Inc.
7. Nailor Industries Inc.
8. NCA Manufacturing, Inc.
9. PHL, Inc.
10. Pottorff; a division of PCI Industries, Inc.
11. Prefco; Perfect Air Control, Inc.
12. Ruskin Company.
13. Vent Products Company, Inc.
14. Ward Industries, Inc.; a division of Hart & Cooley, Inc.
15. <**Insert manufacturer's name**>.

B. Type: **Static**; rated and labeled according to UL 555 by an NRTL.

C. Closing rating in ducts up to [**4-inch wg (1-kPa)** static pressure class and minimum **4000-fpm (20-m/s)** velocity.

D. Fire Rating: **1-1/2 and 3** hours.

E. Frame: **Curtain type with blades inside airstream**; fabricated with roll-formed, 0.034-inch- (0.85-mm-) thick galvanized steel; with mitered and interlocking corners.

F. Mounting Sleeve: Factory- or field-installed, galvanized sheet steel.

1. Minimum Thickness: 0.052 or 0.138 inch (1.3 or 3.5 mm) thick, as indicated, and of length to suit application.

2. Exception: Omit sleeve where damper-frame width permits direct attachment of perimeter mounting angles on each side of wall or floor; thickness of damper frame must comply with sleeve requirements.

G. Mounting Orientation: Vertical or horizontal as indicated.

H. Blades: Roll-formed, interlocking, 0.034-inch- (0.85-mm-) thick, galvanized sheet steel. In place of interlocking blades, use full-length, 0.034-inch- (0.85-mm-) thick, galvanized-steel blade connectors.

I. Horizontal Dampers: Include blade lock and stainless-steel closure spring.

J. Heat-Responsive Device: Replaceable, **165 deg F (74 deg C)**] [**212 deg F (100 deg C)**] <**Insert temperature**> rated, fusible links.

K. Heat-Responsive Device: **Electric** resettable link and switch package, factory installed, [**165 deg F (74 deg C) and212 deg F (100 deg C)** rated.

2.7 CEILING DAMPERS

A. Manufacturers: Subject to compliance with requirements, **available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following**]:

1. Air Balance Inc.; a division of Mestek, Inc.
2. Cesco Products; a division of Mestek, Inc.
3. McGill AirFlow LLC.
4. METALAIRE, Inc.
5. Nailor Industries Inc.
6. Prefco; Perfect Air Control, Inc.
7. Ruskin Company.
8. Vent Products Company, Inc.
9. Ward Industries, Inc.; a division of Hart & Cooley, Inc.

B. General Requirements:

1. Labeled according to UL 555C by an NRTL.
2. Comply with construction details for tested floor- and roof-ceiling assemblies as indicated in UL's "Fire Resistance Directory."

C. Frame: Galvanized sheet steel, round or rectangular, style to suit ceiling construction.

D. Blades: Galvanized sheet steel with refractory insulation.

E. Heat-Responsive Device: Replaceable, **165 deg F (74 deg C)** rated, fusible links.

F. Fire Rating: [**2**] [**3**] <**Insert number**> hours.

2.8 SMOKE DAMPERS

A. Manufacturers: Subject to compliance with requirements, **available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following**:
   1. Greenheck Fan Corporation.
   2. Air Balance Inc.; a division of Mestek, Inc.
   3. Cesco Products; a division of Mestek, Inc.
   4. Nailor Industries Inc.
   5. PHL, Inc.
   6. Ruskin Company.

B. General Requirements: Label according to UL 555S by an NRTL.

C. Smoke Detector: Integral, factory wired for single-point connection.

D. Frame: **Curtain type with blades inside airstream** fabricated with roll-formed, 0.034-inch- (0.85-mm-) thick galvanized steel; with mitered and interlocking corners.

E. Blades: Roll-formed, horizontal, interlocking, 0.034-inch- (0.85-mm-) thick, galvanized sheet steel. In place of interlocking blades, use full-length, 0.034-inch- (0.85-mm-) thick, galvanized-steel blade connectors.

F. Leakage: **Class I**.

G. Rated pressure and velocity to exceed design airflow conditions.

H. Mounting Sleeve: Factory-installed, 0.052-inch- (1.3-mm-) thick, galvanized sheet steel; length to suit wall or floor application[**with factory-furnished silicone calking**].

I. Damper Motors: **Modulating or two-position** action.

J. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Division 15 Section "Common Motor Requirements for HVAC Equipment."
   1. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
   2. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in **Division 16 Sections.**
   3. Permanent-Split-Capacitor or Shaded-Pole Motors: With oil-immersed and sealed gear trains.
   4. Spring-Return Motors: Equip with an integral spiral-spring mechanism where indicated. Enclose entire spring mechanism in a removable housing designed for service or adjustments. Size for running torque rating of 150 in. x lbf (17 N x m) and breakaway torque rating of 150 in. x lbf (17 N x m).
   5. Outdoor Motors and Motors in Outdoor-Air Intakes: Equip with O-ring gaskets designed to make motors weatherproof. Equip motors with internal heaters to permit normal operation at minus 40 deg F (minus 40 deg C).
   6. Nonspring-Return Motors: For dampers larger than 25 sq. ft. (2.3 sq. m), size motor for running torque rating of 150 in. x lbf (17 N x m) and breakaway torque rating of 300 in. x lbf (34 N x m).
   7. Electrical Connection: **115 V, single phase, 60 Hz** .

K. Accessories:

1. Auxiliary switches for **signaling, fan control or position indication**.

2.9 COMBINATION FIRE AND SMOKE DAMPERS

A. Manufacturers: Subject to compliance with requirements, **available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following**:

1. Air Balance Inc.; a division of Mestek, Inc.
2. Cesco Products; a division of Mestek, Inc.
3. Greenheck Fan Corporation.
4. Nailor Industries Inc.
5. Ruskin Company.

B. Type: **Static and dynamic**; rated and labeled according to UL 555 and UL 555S by an NRTL.

C. Closing rating in ducts up to **4-inch wg (1-kPa)** static pressure class and minimum **4000-fpm (20-m/s)** velocity.

D. Fire Rating: **1-1/2 and 3** hours.

E. Frame: **Curtain type with blades inside airstream**; fabricated with roll-formed, 0.034-inch- (0.85-mm-) thick galvanized steel; with mitered and interlocking corners.

F. Heat-Responsive Device: Replaceable, [**165 deg F (74 deg C)**] [**212 deg F (100 deg C)**] rated, fusible links.

G. Heat-Responsive Device: **Electric** resettable link and switch package, factory installed, rated.

H. Smoke Detector: Integral, factory wired for single-point connection.

I. Frame: **Curtain type with blades inside airstream**; fabricated with roll-formed, 0.034-inch- (0.85-mm-) thick galvanized steel; with mitered and interlocking corners.

J. Blades: Roll-formed, horizontal, interlocking, 0.034-inch- (0.85-mm-) thick, galvanized sheet steel. In place of interlocking blades, use full-length, 0.034-inch- (0.85-mm-) thick, galvanized-steel blade connectors.

K. Leakage: **Class I** .

L. Rated pressure and velocity to exceed design airflow conditions.

M. Mounting Sleeve: Factory-installed, 0.052-inch- (1.3-mm-) thick, galvanized sheet steel; length to suit wall or floor application.

N. Master control panel for use in dynamic smoke-management systems.

O. Accessories:

P. Blades: Roll-formed, horizontal, interlocking, 0.034-inch- (0.85-mm-) thick, galvanized sheet steel. In place of interlocking blades, use full-length, 0.034-inch- (0.85-mm-) thick, galvanized-steel blade connectors.

Q. Mounting Sleeve: Factory-installed, 0.052-inch- (1.3-mm-) thick, galvanized sheet steel; length to suit wall or floor application.

R. Damper Motors: **Modulating or two-position** action.

S. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Division 15 Section "Common Motor Requirements for HVAC Equipment."

1. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
2. Permanent-Split-Capacitor or Shaded-Pole Motors: With oil-immersed and sealed gear trains.
3. Spring-Return Motors: Equip with an integral spiral-spring mechanism where indicated. Enclose entire spring mechanism in a removable housing designed for service or adjustments. Size for running torque rating of 150 in. x lbf (17 N x m) and breakaway torque rating of 150 in. x lbf (17 N x m).
4. Outdoor Motors and Motors in Outdoor-Air Intakes: Equip with O-ring gaskets designed to make motors weatherproof. Equip motors with internal heaters to permit normal operation at minus 40 deg F (minus 40 deg C).
5. Nonspring-Return Motors: For dampers larger than 25 sq. ft. (2.3 sq. m), size motor for running torque rating of 150 in. x lbf (17 N x m) and breakaway torque rating of 300 in. x lbf (34 N x m).
6. Electrical Connection: 115 V, single phase, 60 Hz.

2.10 FLANGE CONNECTORS

A. Manufacturers: Subject to compliance with requirements, **available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following**:

1. Ductmate Industries, Inc.
2. Nexus PDQ; Division of Shilco Holdings Inc.
3. Ward Industries, Inc.; a division of Hart & Cooley, Inc.

B. Description: **Add-on**, factory-fabricated, slide-on transverse flange connectors, gaskets, and components.

C. Material: Galvanized steel.

D. Gage and Shape: Match connecting ductwork.

2.11 TURNING VANES

A. Manufacturers: Subject to compliance with requirements, **available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following**:

1. Ductmate Industries, Inc.
2. Duro Dyne Inc.
3. METALAIRE, Inc.
4. SEMCO Incorporated.
5. Ward Industries, Inc.; a division of Hart & Cooley, Inc.

B. Manufactured Turning Vanes for Metal Ducts: Curved blades of galvanized sheet steel; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.

1. Acoustic Turning Vanes: Fabricate airfoil-shaped aluminum extrusions with perforated faces and fibrous-glass fill.

C. Manufactured Turning Vanes for Nonmetal Ducts: Fabricate curved blades of resin-bonded fiberglass with acrylic polymer coating; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.

D. General Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 2-3, "Vanes and Vane Runners," and 2-4, "Vane Support in Elbows."

E. Vane Construction: **Single** wall.

F. Vane Construction: Single wall for ducts up to **48 inches (1200 mm)** wide and double wall for larger dimensions.

2.12 DUCT-MOUNTED ACCESS DOORS

A. 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. American Warming and Ventilating; a division of Mestek, Inc.
2. Cesco Products; a division of Mestek, Inc.
3. Ductmate Industries, Inc.
4. Flexmaster U.S.A., Inc.
5. Greenheck Fan Corporation.
6. McGill AirFlow LLC.
7. Nailor Industries Inc.
8. Pottorff; a division of PCI Industries, Inc.
9. Ventfabrics, Inc.
10. Ward Industries, Inc.; a division of Hart & Cooley, Inc.

B. Duct-Mounted Access Doors: Fabricate access panels according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 2-10, "Duct Access Doors and Panels," and 2-11, "Access Panels - Round Duct."

1. Door:

a. Double wall, rectangular.
b. Galvanized sheet metal with insulation fill and thickness as indicated for duct pressure class.
c. Vision panel.
d. Hinges and Latches: 1-by-1-inch (25-by-25-mm) butt or piano hinge and cam latches.
e. Fabricate doors airtight and suitable for duct pressure class.

2. Frame: Galvanized sheet steel, with bend-over tabs and foam gaskets.
3. Number of Hinges and Locks:

    a. Access Doors Less Than 12 Inches (300 mm) Square: No hinges and two sash locks.
    b. Access Doors up to 18 Inches (460 mm) Square: Two hinges and two sash locks.
    c. Access Doors up to 24 by 48 Inches (600 by 1200 mm): Three hinges and two compression latches **with outside and inside handles**.
    d. Access Doors Larger than 24 by 48 Inches (600 by 1200 mm): Four hinges and two compression latches with outside and inside handles.

2.13 FLEXIBLE CONNECTORS

A. Manufacturers: Subject to compliance with requirements, **available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following**]:

1. Ductmate Industries, Inc.
2. Duro Dyne Inc.
3. Ventfabrics, Inc.
4. Ward Industries, Inc.; a division of Hart & Cooley, Inc.

B. Materials: Flame-retardant or noncombustible fabrics.

C. Coatings and Adhesives: Comply with UL 181, Class 1.

D. Metal-Edged Connectors: Factory fabricated with a fabric strip [**3-1/2 inches (89 mm)**] [**5-3/4 inches (146 mm)**] wide attached to 2 strips of 2-3/4-inch- (70-mm-) wide, 0.028-inch- (0.7-mm-) thick, galvanized sheet steel or 0.032-inch- (0.8-mm-) thick aluminum sheets. Provide metal compatible with connected ducts.

E. Indoor System, Flexible Connector Fabric: Glass fabric double coated with neoprene.

1. Minimum Weight: 26 oz./sq. yd. (880 g/sq. m).
2. Tensile Strength: 480 lbf/inch (84 N/mm) in the warp and 360 lbf/inch (63 N/mm) in the filling.
3. Service Temperature: Minus 40 to plus 200 deg F (Minus 40 to plus 93 deg C).

2.14 FLEXIBLE DUCTS

A. 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**:

1. Flexmaster U.S.A., Inc.
2. McGill AirFlow LLC.
3. Ward Industries, Inc.; a division of Hart & Cooley, Inc.

B. Insulated, Flexible Duct: UL 181, Class 1, 2-ply vinyl film supported by helically wound, spring-steel wire; fibrous-glass insulation; [**polyethylene**] [**aluminized**] vapor-barrier film.

1. Pressure Rating: 10-inch wg (2500 Pa) positive and 1.0-inch wg (250 Pa) negative.

2. Maximum Air Velocity: 4000 fpm (20 m/s).
3. Temperature Range: Minus 10 to plus 160 deg F (Minus 23 to plus 71 deg C).
4. Insulation R-value: **Comply with ASHRAE/IESNA 90.1-2004**.

C. Insulated, Flexible Duct: UL 181, Class 1, black polymer film supported by helically wound, spring-steel wire; fibrous-glass insulation; **polyethylene** vapor-barrier film.

1. Pressure Rating: 4-inch wg (1000 Pa) positive and 0.5-inch wg (125 Pa) negative.
2. Maximum Air Velocity: 4000 fpm (20 m/s).
3. Temperature Range: Minus 20 to plus 175 deg F (Minus 29 to plus 79 deg C).
4. Insulation R-value: **Comply with ASHRAE/IESNA 90.1-2004**.

D. Insulated, Flexible Duct: UL 181, Class 0, interlocking spiral of aluminum foil; fibrous-glass insulation; [**polyethylene**] [**aluminized**] vapor-barrier film.

1. Pressure Rating: 8-inch wg (2280 Pa) positive or negative.
2. Maximum Air Velocity: 5000 fpm (25 m/s).
3. Temperature Range: Minus 20 to plus 250 deg F (Minus 29 to plus 121 deg C).
4. Insulation R-value: **Comply with ASHRAE/IESNA 90.1-2004**.

E. Flexible Duct Connectors:

1. Clamps: **Stainless-steel band with cadmium-plated hex screw to tighten band with a worm-gear action** in sizes 3 through 18 inches (75 through 460 mm), to suit duct size.

2.15 DUCT SECURITY BARS

A. Manufacturers: Subject to compliance with requirements, **available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following**:

1. Carnes.
2. KEES, Inc.
3. Lloyd Industries, Inc.
4. Metal Form Manufacturing, Inc.
5. Price Industries.

B. Description: **Field- or factory-fabricated and field-installed** duct security bars.

C. Configuration:

1. Frame: **10 gage by 2 inches (3.57 mm by 50 mm)**
2. Horizontal Bars: **1/2 inch (13 mm)**.
3. Vertical Bars: **1/2 inch (13 mm))**]
4. Bar Spacing: **6 inches (150 mm)**

2.16 DUCT ACCESSORY HARDWARE

A. Instrument Test Holes: Cast iron or cast aluminum to suit duct material, including screw cap and gasket. Size to allow insertion of pitot tube and other testing instruments and of length to suit duct-insulation thickness.

B. Adhesives: High strength, quick setting, neoprene based, waterproof, and resistant to gasoline and grease.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install duct accessories according to applicable details in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for metal ducts and in NAIMA AH116, "Fibrous Glass Duct Construction Standards," for fibrous-glass ducts.

B. Install duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel and fibrous-glass ducts, stainless-steel accessories in stainless-steel ducts, and aluminum accessories in aluminum ducts.

C. Install [**backdraft**] [**control**] dampers at inlet of exhaust fans or exhaust ducts as close as possible to exhaust fan unless otherwise indicated.

D. Install volume dampers at points on supply, return, and exhaust systems where branches extend from larger ducts. Where dampers are installed in ducts having duct liner, install dampers with hat channels of same depth as liner, and terminate liner with nosing at hat channel.

1. Install steel volume dampers in steel ducts.
2. Install aluminum volume dampers in aluminum ducts.

E. Set dampers to fully open position before testing, adjusting, and balancing.

F. Install test holes at fan inlets and outlets and elsewhere as indicated.

G. Install fire **and smoke** dampers according to UL listing.

H. Install duct security bars. Construct duct security bars from 0.164-inch (4.18-mm) steel sleeve, continuously welded at all joints and 1/2-inch- (13-mm-) diameter steel bars, 6 inches (150 mm) o.c. in each direction in center of sleeve. Weld each bar to steel sleeve and each crossing bar. Weld 2-1/2-by-2-1/2-by-1/4-inch (63-by-63-by-6-mm) steel angle to 4 sides and both ends of sleeve. Connect duct security bars to ducts with flexible connections. Provide 12-by-12-inch (300-by-300-mm) hinged access panel with cam lock in duct in each side of sleeve.

I. Connect ducts to duct silencers **with flexible duct connectors**

J. Install duct access doors on sides of ducts to allow for inspecting, adjusting, and maintaining accessories and equipment at the following locations:

1. On both sides of duct coils.
2. Upstream [**and downstream** from duct filters.
3. At outdoor-air intakes and mixed-air plenums.
4. At drain pans and seals.
5. Downstream from manual volume dampers, control dampers, backdraft dampers, and equipment.
6. Adjacent to and close enough to fire or smoke dampers, to reset or reinstall fusible links. Access doors for access to fire or smoke dampers having fusible links shall be pressure

relief access doors and shall be outward operation for access doors installed upstream from dampers and inward operation for access doors installed downstream from dampers.

7. Control devices requiring inspection.
8. Elsewhere as indicated.

K. Install access doors with swing against duct static pressure.

L. Access Door Sizes:

1. One-Hand or Inspection Access: 8 by 5 inches (200 by 125 mm).
2. Two-Hand Access: 12 by 6 inches (300 by 150 mm).
3. Head and Hand Access: 18 by 10 inches (460 by 250 mm).
4. Head and Shoulders Access: 21 by 14 inches (530 by 355 mm).
5. Body Access: 25 by 14 inches (635 by 355 mm).
6. Body plus Ladder Access: 25 by 17 inches (635 by 430 mm).

M. Label access doors according to Division 15 Section "Identification for HVAC Piping and Equipment" to indicate the purpose of access door.

N. Install flexible connectors to connect ducts to equipment.

O. For fans developing static pressures of 5-inch w g (1250 Pa) and more, cover flexible connectors with loaded vinyl sheet held in place with metal straps.

P. Connect terminal units to supply ducts with maximum **12-inch (300-mm)** lengths of flexible duct. Do not use flexible ducts to change directions.

Q.

R. Connect flexible ducts to metal ducts with **liquid adhesive plus tape and draw bands** or **adhesive plus sheet metal screws**.

S. Install duct test holes where required for testing and balancing purposes.

T. Install thrust limits at centerline of thrust, symmetrical on both sides of equipment. Attach thrust limits at centerline of thrust and adjust to a maximum of 1/4-inch (6-mm) movement during start and stop of fans.

3.2 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. Operate dampers to verify full range of movement.
2. Inspect locations of access doors and verify that purpose of access door can be performed.
3. Operate fire, smoke, and combination fire and smoke dampers to verify full range of movement and verify that proper heat-response device is installed.
4. Inspect turning vanes for proper and secure installation.
5. Operate remote damper operators to verify full range of movement of operator and damper.

END OF SECTION 15820

SECTION 15837 - CENTRIFUGAL FANS

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. Airfoil centrifugal fans.
2. Backward-inclined centrifugal fans.
3. Forward-curved centrifugal fans.
4. Plenum fans.
5. Plug fans.

1.3 PERFORMANCE REQUIREMENTS

A. Project Altitude: Base fan performance ratings on [**actual Project site elevations above**] sea level.

B. Operating Limits: Classify according to AMCA 99.

1.4 SUBMITTALS

A. Product Data: Include rated capacities, furnished specialties, and accessories for each type of product indicated and include the following:

1. Certified fan performance curves with system operating conditions indicated.
2. Certified fan sound-power ratings.
3. Motor ratings and electrical characteristics, plus motor and electrical accessories.
4. Material thickness and finishes, including color charts.
5. Dampers, including housings, linkages, and operators.

B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

1. Wiring Diagrams: Power, signal, and control wiring.
2. Design Calculations: Calculate requirements for selecting vibration isolators and seismic restraints and for designing vibration isolation bases.

3. Vibration Isolation Base Details: Detail fabrication, including anchorages and attachments to structure and to supported equipment. Include auxiliary motor slides and rails, and base weights.

C. Coordination Drawings: Show fan room layout and relationships between components and adjacent structural and mechanical elements. Show support locations, type of support, and weight on each support. Indicate and certify field measurements.

D. Field quality-control test reports.

E. Operation and Maintenance Data: For centrifugal fans to include in emergency, operation, and maintenance manuals.

1.5 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. AMCA Compliance: Products shall comply with performance requirements and shall be licensed to use the AMCA-Certified Ratings Seal.

C. NEMA Compliance: Motors and electrical accessories shall comply with NEMA 1.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver fans as factory-assembled units, to the extent allowable by shipping limitations, with protective crating and covering.

B. Disassemble and reassemble units, as required for moving to the final location, according to manufacturer's written instructions.

C. Lift and support units with manufacturer's designated lifting or supporting points.

1.7 COORDINATION

A. Coordinate size and location of structural-steel support members.

B. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 3.

C. Coordinate installation of roof curbs, equipment supports, and roof penetrations. These items are specified in Division 7 Section "Roof Accessories."

1.8 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Belts: [**One**] <**Insert number**> set(s) for each belt-driven unit.

PART 2 - PRODUCTS

2.1 BACKWARD-INCLINED CENTRIFUGAL FANS

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. Geenheck Fan Company.
2. Acme Engineering & Mfg. Corp.
3. Aerovent; a Twin City Fan Company.
4. Airmaster Fan Co.
5. Ammerman; General Resource Corp.
6. Bayley Fans; a division of Lau Industries, Inc.
7. Carrier Corporation.
8. Central Blower Company.
9. Chicago Blower Corporation.
10. Cincinnati Fan.
11. CML Northern Blower Inc.
12. Howden Fan Co.
13. Industrial Air; a division of Lau Industries, Inc.
14. Loren Cook Company.
15. Madison Manufacturing.
16. New Philadelphia Fan Co.
17. New York Blower Company (The).
18. Trane.

B. Description: Factory-fabricated, -assembled, -tested, and -finished, belt-driven centrifugal fans consisting of housing, wheel, fan shaft, bearings, motor **and disconnect switch**, drive assembly, and support structure.

C. Housings: Formed panels to make curved-scroll housings with shaped cutoff; with doors or panels to allow access to internal parts and components.

1. Panel Bracing: Steel angle- or channel-iron member supports for mounting and supporting fan scroll, wheel, motor, and accessories.
2. Horizontally split, bolted-flange housing.
3. Spun inlet cone with flange.
4. Outlet flange.

D. Backward-Inclined Wheels: Single-width-single-inlet and double-width-double-inlet construction with curved inlet flange, backplate, backward-inclined blades **welded or riveted to flange and backplate; cast-iron or cast-steel hub riveted to backplate** and fastened to shaft with set screws.

E. Shafts: Statically and dynamically balanced and selected for continuous operation at maximum rated fan speed and motor horsepower, with final alignment and belt adjustment made after installation.

1. Turned, ground, and polished hot-rolled steel with keyway. Ship with a protective coating of lubricating oil.
2. Designed to operate at no more than 70 percent of first critical speed at top of fan's speed range.

F. Prelubricated and Sealed Shaft Bearings: Self-aligning, pillow-block-type ball bearings.

1. Ball-Bearing Rating Life: ABMA 9, Ll0 at **120,000 hours**.
2. Roller-Bearing Rating Life: ABMA 11, Ll0 at **120,000 hours**.

G. Belt Drives: Factory mounted, with final alignment and belt adjustment made after installation.

1. Service Factor Based on Fan Motor Size: **1.5**.
2. Fan Pulleys: Cast iron or cast steel with split, tapered bushing; dynamically balanced at factory.
3. Motor Pulleys: Adjustable pitch for use with motors through [**5**] <**Insert number**> hp; fixed pitch for use with larger motors. Select pulley so pitch adjustment is at the middle of adjustment range at fan design conditions.
4. Belts: Oil resistant, non-sparking, and non-static; matched sets for multiple belt drives.
5. Belt Guards: Fabricate to comply with OSHA and SMACNA requirements of diamond-mesh wire screen welded to steel angle frame or equivalent, prime coated. Secure to fan or fan supports without short circuiting vibration isolation. Include provisions for adjustment of belt tension, lubrication, and use of tachometer with guard in place.
6. Motor Mount: Adjustable for belt tensioning.

H. Accessories:

1. Scroll Access Doors: Shaped to conform to scroll, with quick-opening latches and gaskets.
2. Cleanout Door: -**Bolted** gasketed door allowing access to fan scroll, of same material as housing.
3. Scroll Drain Connection: NPS 1 (DN 25) steel pipe coupling welded to low point of fan scroll.
4. Companion Flanges: Rolled flanges for duct connections of same material as housing.
5. Variable Inlet Vanes: With blades supported at both ends with two permanently lubricated bearings of same material as housing. Variable mechanism terminating in single control lever with control shaft for double-width fans.
6. Discharge Dampers: Assembly with -**parallel**- blades constructed of two plates formed around and to shaft, channel frame, and sealed ball bearings; with blades linked outside of airstream to single control lever of same material as housing.

7. Inlet Screens: Grid screen of same material as housing.
8. Shaft Cooler: Metal disk between bearings and fan wheel, designed to dissipate heat from shaft.
9. Spark-Resistant Construction: AMCA 99.
10. Shaft Seals: Airtight seals installed around shaft on drive side of single-width fans.
11. Weather Cover: Enameled-steel sheet with ventilation slots, bolted to housing.

I. Motors: Comply with requirements in Division 15 Section "Motors."

1. -
2. -

3. Vibration Isolators: **Spring isolators** having a static deflection of **1 inch (25 mm)**.
4. Spark Arrestance Class: **A**.

2.2 FORWARD-CURVED CENTRIFUGAL FANS

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. Greenheck Fan Company.
2. Acme Engineering & Mfg. Corp.
3. Aerovent; a Twin City Fan Company.
4. Airmaster Fan Co.
5. Ammerman; General Resource Corp.
6. Bayley Fans; a division of Lau Industries, Inc.
7. Carrier Corporation.
8. Central Blower Corporation.
9. Chicago Blower Corporation.
10. Cincinnati Fan.
11. CML Northern Blower Inc.
12. Howden Fan Co.
13. Industrial Air; a division of Lau Industries, Inc.
14. Loren Cook Company.
15. Madison Manufacturing.
16. New Philadelphia Fan Co.
17. New York Blower Company (The).
18. Trane.

B. Description: Factory-fabricated, -assembled, -tested, and -finished, belt-driven centrifugal fans consisting of housing, wheel, fan shaft, bearings, motor **and disconnect switch**, drive assembly, and support structure.

C. Housings: Formed panels to make curved-scroll housings with shaped cutoff; with doors or panels to allow access to internal parts and components.

1. Panel Bracing: Steel angle- or channel-iron member supports for mounting and supporting fan scroll, wheel, motor, and accessories.

2. Horizontally split, bolted-flange housing.
3. Spun inlet cone with flange.
4. Outlet flange.

D. Forward-Curved Wheels: Black-enameled or galvanized steel construction with inlet flange, backplate, shallow blades with inlet and tip curved forward in direction of airflow, mechanically secured to flange and backplate; cast-steel hub swaged to backplate and fastened to shaft with set screws.

E. Shafts: Statically and dynamically balanced and selected for continuous operation at maximum rated fan speed and motor horsepower, with final alignment and belt adjustment made after installation.

1. Turned, ground, and polished hot-rolled steel with keyway. Ship with protective coating of lubricating oil.
2. Designed to operate at no more than 70 percent of first critical speed at top of fan's speed range.

F. Pre lubricated and Sealed Shaft Bearings: Self-aligning, pillow-block-type ball bearings.

1. Ball-Bearing Rating Life: ABMA 9, Ll0 at **120,000 hours**.
2. Roller-Bearing Rating Life: ABMA 11, Ll0 at **120,000 hours**.

G. Belt Drives: Factory mounted, with final alignment and belt adjustment made after installation.

1. Service Factor Based on Fan Motor Size: **1.5**.
2. Fan Pulleys: Cast iron or cast steel with split, tapered bushing; dynamically balanced at factory.
3. Motor Pulleys: Adjustable pitch for use with motors through [**5**] hp; fixed pitch for use with larger motors. Select pulley so pitch adjustment is at the middle of adjustment range at fan design conditions.
4. Belts: Oil resistant, non sparking, and non static; matched sets for multiple belt drives.
5. Belt Guards: Fabricate to comply with OSHA and SMACNA requirements of diamond-mesh wire screen welded to steel angle frame or equivalent, prime coated. Secure to fan or fan supports without short circuiting vibration isolation. Include provisions for adjustment of belt tension, lubrication, and use of tachometer with guard in place.
6. Motor Mount: Adjustable for belt tensioning.

H. Accessories:

1. Scroll Access Doors: Shaped to conform to scroll, with quick-opening latches and gaskets.
2. Cleanout Door: **Bolted** gasketed door allowing access to fan scroll, of same material as housing.
3. Scroll Drain Connection: NPS 1 (DN 25) steel pipe coupling welded to low point of fan scroll.
4. Companion Flanges: Rolled flanges for duct connections of same material as housing.

5. Variable Inlet Vanes: With blades supported at both ends with two permanently lubricated bearings of same material as housing. Variable mechanism terminating in single control lever with control shaft for double-width fans.
6. Discharge Dampers: Assembly with **parallel** blades constructed of two plates formed around and to shaft, channel frame, and sealed ball bearings; with blades linked outside of airstream to single control lever of same material as housing.
7. Inlet Screens: Grid screen of same material as housing.
8. Shaft Cooler: Metal disk between bearings and fan wheel, designed to dissipate heat from shaft.
9. Spark-Resistant Construction: AMCA 99.
10. Shaft Seals: Airtight seals installed around shaft on drive side of single-width fans.
11. Weather Cover: Enameled-steel sheet with ventilation slots, bolted to housing.

I. Motors: Comply with requirements in Division 15 Section "Motors."

2.3 SOURCE QUALITY CONTROL

A. Sound-Power Level Ratings: Comply with AMCA 301, "Methods for Calculating Fan Sound Ratings from Laboratory Test Data." Factory test fans according to AMCA 300, "Reverberant Room Method for Sound Testing of Fans." Label fans with the AMCA-Certified Ratings Seal.

B. Fan Performance Ratings: Establish flow rate, pressure, power, air density, speed of rotation, and efficiency by factory tests and ratings according to AMCA 210, "Laboratory Methods of Testing Fans for Rating."

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install centrifugal fans level and plumb.

B. Support floor-mounting units using **spring isolators** having a static deflection of **1 inch (25 mm).** Vibration- and seismic-control devices are specified in Division 15 Section "Mechanical Vibration and Seismic Controls."

1. Secure vibration and seismic controls to concrete bases using anchor bolts cast in concrete base.

C. Install floor-mounting units on concrete bases. Concrete, reinforcement, and formwork requirements are specified in Division 3 Section "Cast-in-Place Concrete."

D. Install floor-mounting units on concrete bases designed to withstand, without damage to equipment, the seismic force required by authorities having jurisdiction. Concrete, reinforcement, and formwork requirements are specified in Division 3 Section "Cast-in-Place Concrete."

E. Support suspended units from structure using threaded steel rods and **elastomeric hangers** having a static deflection of **1 inch (25 mm)**. Vibration-control devices are specified in Division 15 Section "Mechanical Vibration and Seismic Controls."

F. Install units with clearances for service and maintenance.

G. Label fans according to requirements specified in Division 15 Section "Mechanical Identification."

3.2 CONNECTIONS

A. Duct installation and connection requirements are specified in other Division 15 Sections. Drawings indicate general arrangement of ducts and duct accessories. Make final duct connections with flexible connectors. Flexible connectors are specified in Division 15 Section "Duct Accessories."

B. Install ducts adjacent to fans to allow service and maintenance.

C. Install line-sized piping from scroll drain connection, with trap with seal equal to 1.5 times specified static pressure, to nearest floor drain.

D. Ground equipment according to Division 16 Section "Grounding and Bonding."

E. Connect wiring according to Division 16 Section "Conductors and Cables."

3.3 FIELD QUALITY CONTROL

A. Perform the following field tests and inspections and prepare test reports:

1. Verify that shipping, blocking, and bracing are removed.
2. Verify that unit is secure on mountings and supporting devices and that connections to ducts and electrical components are complete. Verify that proper thermal-overload protection is installed in motors, starters, and disconnect switches.
3. Verify that cleaning and adjusting are complete.
4. Disconnect fan drive from motor, verify proper motor rotation direction, and verify fan wheel free rotation and smooth bearing operation. Reconnect fan drive system, align and adjust belts, and install belt guards.
5. Adjust belt tension.
6. Adjust damper linkages for proper damper operation.
7. Verify lubrication for bearings and other moving parts.
8. Verify that manual and automatic volume control and fire and smoke dampers in connected ductwork systems are in fully open position.
9. Refer to Division 15 Section "Testing, Adjusting, and Balancing" for testing, adjusting, and balancing procedures.
10. Remove and replace malfunctioning units and retest as specified above.

B. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

3.4 DEMONSTRATION

A. **Train** Owner's maintenance personnel to adjust, operate, and maintain centrifugal fans. Refer to Division 1 Section "Demonstration and Training."

END OF SECTION 15837

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 TAB to produce design objectives for the following:

1. Constant-volume air systems.
2. HVAC equipment quantitative-performance settings.
3. Verifying that automatic control devices are functioning properly.
4. Reporting results of activities and procedures specified in this Section.

1.3 DEFINITIONS

A. Adjust: To regulate fluid flow rate and air patterns at the terminal equipment, such as to reduce fan speed or adjust a damper.

B. Balance: To proportion flows within the distribution system, including submains, branches, and terminals, according to indicated quantities.

C. Draft: A current of air, when referring to localized effect caused by one or more factors of high air velocity, low ambient temperature, or direction of airflow, whereby more heat is withdrawn from a person's skin than is normally dissipated.

D. NC: Noise criteria.

E. Procedure: An approach to and execution of a sequence of work operations to yield repeatable results.

F. RC: Room criteria.

G. Report Forms: Test data sheets for recording test data in logical order.

H. Static Head: The pressure due to the weight of the fluid above the point of measurement. In a closed system, static head is equal on both sides of the pump.

I. Suction Head: The height of fluid surface above the centerline of the pump on the suction side.

J. System Effect: A phenomenon that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.

K. System Effect Factors: Allowances used to calculate a reduction of the performance ratings of a fan when installed under conditions different from those presented when the fan was performance tested.

L. TAB: Testing, adjusting, and balancing.

M. Terminal: A point where the controlled medium, such as fluid or energy, enters or leaves the distribution system.

N. Test: A procedure to determine quantitative performance of systems or equipment.

O. Testing, Adjusting, and Balancing (TAB) Firm: The entity responsible for performing and reporting TAB procedures.

1.4 SUBMITTALS

A. Certified TAB Reports: Submit two copies of reports prepared, as specified in this Section, on approved forms certified by TAB firm.

B. Sample Report Forms: Submit two sets of sample TAB report forms.

C. Warranties specified in this Section.

1.5 COORDINATION

A. Coordinate the efforts of factory-authorized service representatives for systems and equipment, HVAC controls installers, and other mechanics to operate HVAC systems and equipment to support and assist TAB activities.

B. Notice: Provide seven days' advance notice for each test. Include scheduled test dates and times.

C. Perform TAB after leakage and pressure tests on air and water distribution systems have been satisfactorily completed.

1.6 WARRANTY

A. National Project Performance Guarantee: Provide a guarantee on AABC's "National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems" forms stating that AABC will assist in completing requirements of the Contract Documents if TAB firm fails to comply with the Contract Documents. Guarantee includes the following provisions:

B. Special Guarantee: Provide a guarantee on NEBB forms stating that NEBB will assist in completing requirements of the Contract Documents if TAB firm fails to comply with the Contract Documents. Guarantee shall include the following provisions:

1. The certified TAB firm has tested and balanced systems according to the Contract Documents.
2. Systems are balanced to optimum performance capabilities within design and installation limits.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems' designs that may preclude proper TAB of systems and equipment.

1. Contract Documents are defined in the General and Supplementary Conditions of Contract.
2. Verify that balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers, are required by the Contract Documents. Verify that quantities and locations of these balancing devices are accessible and appropriate for effective balancing and for efficient system and equipment operation.

B. Examine approved submittal data of HVAC systems and equipment.

C. Examine Project Record Documents described in Division 1 Section "Project Record Documents."

D. Examine design data, including HVAC system descriptions, statements of design assumptions for environmental conditions and systems' output, and statements of philosophies and assumptions about HVAC system and equipment controls.

E. Examine equipment performance data including fan and pump curves. Relate performance data to Project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system. Calculate system effect factors to reduce performance ratings of HVAC equipment when installed under conditions different from those presented when the equipment was performance tested at the factory. To calculate system effects for air systems, use tables and charts found in AMCA 201, "Fans and Systems," Sections 7 through 10; or in SMACNA's "HVAC Systems--Duct Design," Sections 5 and 6. Compare this data with the design data and installed conditions.

F. Examine system and equipment installations to verify that they are complete and that testing, cleaning, adjusting, and commissioning specified in individual Sections have been performed.

G. Examine system and equipment test reports.

H. Examine HVAC system and equipment installations to verify that indicated balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers, are properly installed, and that their locations are accessible and appropriate for effective balancing and for efficient system and equipment operation.

I. Examine systems for functional deficiencies that cannot be corrected by adjusting and balancing.

J. Examine HVAC equipment to ensure that clean filters have been installed, bearings are greased, belts are aligned and tight, and equipment with functioning controls is ready for operation.

K. Examine strainers for clean screens and proper perforations.

L. Examine three-way valves for proper installation for their intended function of diverting or mixing fluid flows.

M. Examine heat-transfer coils for correct piping connections and for clean and straight fins.

N. Examine system pumps to ensure absence of entrained air in the suction piping.

O. Examine equipment for installation and for properly operating safety interlocks and controls.

P. Examine automatic temperature system components to verify the following:

1. Dampers, valves, and other controlled devices are operated by the intended controller.
2. Dampers and valves are in the position indicated by the controller.
3. Integrity of valves and dampers for free and full operation and for tightness of fully closed and fully open positions. This includes dampers in multizone units, mixing boxes, and variable-air-volume terminals.
4. Automatic modulating and shutoff valves, including two-way valves and three-way mixing and diverting valves, are properly connected.
5. Thermostats and humidistats are located to avoid adverse effects of sunlight, drafts, and cold walls.
6. Sensors are located to sense only the intended conditions.
7. Sequence of operation for control modes is according to the Contract Documents.
8. Controller set points are set at indicated values.
9. Interlocked systems are operating.
10. Changeover from heating to cooling mode occurs according to indicated values.

Q. Report deficiencies discovered before and during performance of TAB procedures. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.

3.2 PREPARATION

A. Prepare a TAB plan that includes strategies and step-by-step procedures.

B. Complete system readiness checks and prepare system readiness reports. Verify the following:

1. Permanent electrical power wiring is complete.
2. Automatic temperature-control systems are operational.
3. Equipment and duct access doors are securely closed.
4. Balance, smoke, and fire dampers are open.
5. Isolating and balancing valves are open and control valves are operational.
6. Ceilings are installed in critical areas where air-pattern adjustments are required and access to balancing devices is provided.
7. Windows and doors can be closed so indicated conditions for system operations can be met.

3.3 GENERAL PROCEDURES FOR TESTING AND BALANCING

A. Perform testing and balancing procedures on each system according to the procedures contained in SMACNA's "HVAC Systems - Testing, Adjusting, and Balancing" and this Section.

B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary to allow adequate performance of procedures. After testing and balancing, close probe holes and patch insulation with new materials identical to those removed. Restore vapor barrier and finish according to insulation Specifications for this Project.

C. Mark equipment and balancing device settings with paint or other suitable, permanent identification material, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, to show final settings.

3.4 PROCEDURES FOR CONSTANT-VOLUME AIR SYSTEMS

A. Adjust fans to deliver total indicated airflows within the maximum allowable fan speed listed by fan manufacturer.

1. Measure fan static pressures to determine actual static pressure as follows:

    a. Measure outlet static pressure as far downstream from the fan as practicable and upstream from restrictions in ducts such as elbows and transitions.
    b. Measure static pressure directly at the fan outlet or through the flexible connection.
    c. Measure inlet static pressure of single-inlet fans in the inlet duct as near the fan as possible, upstream from flexible connection and downstream from duct restrictions.
    d. Measure inlet static pressure of double-inlet fans through the wall of the plenum that houses the fan.

2. Measure static pressure across each component that makes up an air-handling unit, rooftop unit, and other air-handling and -treating equipment.

    a. Simulate dirty filter operation and record the point at which maintenance personnel must change filters.

3. Measure static pressures entering and leaving other devices such as sound traps, heat recovery equipment, and air washers, under final balanced conditions.
4. Compare design data with installed conditions to determine variations in design static pressures versus actual static pressures. Compare actual system effect factors with calculated system effect factors to identify where variations occur. Recommend corrective action to align design and actual conditions.
5. Obtain approval from Engineer for adjustment of fan speed higher or lower than indicated speed. Make required adjustments to pulley sizes, motor sizes, and electrical connections to accommodate fan-speed changes.
6. Do not make fan-speed adjustments that result in motor overload. Consult equipment manufacturers about fan-speed safety factors. Modulate dampers and measure fan-motor amperage to ensure that no overload will occur. Measure amperage in full cooling, full heating, economizer, and any other operating modes to determine the maximum required brake horsepower.

B. Adjust volume dampers for main duct, submain ducts, and major branch ducts to indicated airflows within specified tolerances.

1. Measure static pressure at a point downstream from the balancing damper and adjust volume dampers until the proper static pressure is achieved.

a. Where sufficient space in submain and branch ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow for that zone.

2. Re measure each submain and branch duct after all have been adjusted. Continue to adjust submain and branch ducts to indicated airflows within specified tolerances.

C. Measure terminal outlets and inlets without making adjustments.

1. Measure terminal outlets using a direct-reading hood or outlet manufacturer's written instructions and calculating factors.

D. Adjust terminal outlets and inlets for each space to indicated airflows within specified tolerances of indicated values. Make adjustments using volume dampers rather than extractors and the dampers at air terminals.

1. Adjust each outlet in same room or space to within specified tolerances of indicated quantities without generating noise levels above the limitations prescribed by the Contract Documents.
2. Adjust patterns of adjustable outlets for proper distribution without drafts.

3.5 PROCEDURES FOR MOTORS

A. Motors, 1/2 HP and Larger: Test at final balanced conditions and record the following data:

1. Manufacturer, model, and serial numbers.
2. Motor horsepower rating.
3. Motor rpm.
4. Efficiency rating.
5. Nameplate and measured voltage, each phase.
6. Nameplate and measured amperage, each phase.
7. Starter thermal-protection-element rating.

3.6 PROCEDURES FOR CONDENSING UNITS

A. Verify proper rotation of fans.

B. Measure entering- and leaving-air temperatures.

C. Record compressor data.

3.7 PROCEDURES FOR HEAT-TRANSFER COILS

A. Refrigerant Coils: Measure the following data for each coil:

1. Dry-bulb temperature of entering and leaving air.
2. Wet-bulb temperature of entering and leaving air.
3. Airflow.
4. Air pressure drop.
5. Refrigerant suction pressure and temperature.

3.8 PROCEDURES FOR TEMPERATURE MEASUREMENTS

A. During TAB, report the need for adjustment in temperature regulation within the automatic temperature-control system.

B. Measure indoor wet- and dry-bulb temperatures every other hour for a period of two successive eight-hour days, in each separately controlled zone, to prove correctness of final temperature settings. Measure when the building or zone is occupied.

C. Measure outside-air, wet- and dry-bulb temperatures.

3.9 TEMPERATURE-CONTROL VERIFICATION

A. Verify that controllers are calibrated and commissioned.

B. Check transmitter and controller locations and note conditions that would adversely affect control functions.

C. Record controller settings and note variances between set points and actual measurements.

D. Check the operation of limiting controllers (i.e., high- and low-temperature controllers).

E. Check free travel and proper operation of control devices such as damper and valve operators.

F. Check the sequence of operation of control devices. Note air pressures and device positions and correlate with airflow and water flow measurements. Note the speed of response to input changes.

G. Check the interaction of electrically operated switch transducers.

H. Check the interaction of interlock and lockout systems.

I. Check main control supply-air pressure and observe compressor and dryer operations.

J. Record voltages of power supply and controller output. Determine whether the system operates on a grounded or non grounded power supply.

K. Note operation of electric actuators using spring return for proper fail-safe operations.

3.10 TOLERANCES

A. Set HVAC system airflow and water flow rates within the following tolerances:

1. Supply, Return, and Exhaust Fans and Equipment with Fans: Plus 5 to plus 10 percent.
2. Air Outlets and Inlets: 0 to minus 10 percent.

3.11 FINAL REPORT

A. General: Typewritten, or computer printout in letter-quality font, on standard bond paper, in three-ring binder, tabulated and divided into sections by tested and balanced systems.

B. Include a certification sheet in front of binder signed and sealed by the certified testing and balancing engineer.

1. Include a list of instruments used for procedures, along with proof of calibration.

C. Final Report Contents: In addition to certified field report data, include the following:

1. Pump curves.
2. Fan curves.
3. Manufacturers' test data.
4. Field test reports prepared by system and equipment installers.
5. Other information relative to equipment performance, but do not include Shop Drawings and Product Data.

D. General Report Data: In addition to form titles and entries, include the following data in the final report, as applicable:

1. Title page.
2. Name and address of TAB firm.
3. Project name.
4. Project location.
5. Engineer's name and address.
6. Contractor's name and address.
7. Report date.
8. Signature of TAB firm who certifies the report.
9. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.
10. Summary of contents including the following:

    a. Indicated versus final performance.
    b. Notable characteristics of systems.
    c. Description of system operation sequence if it varies from the Contract Documents.

11. Nomenclature sheets for each item of equipment.
12. Data for terminal units, including manufacturer, type size, and fittings.
13. Notes to explain why certain final data in the body of reports varies from indicated values.
14. Test conditions for fans and pump performance forms including the following:

    a. Settings for outside-, return-, and exhaust-air dampers.
    b. Conditions of filters.
    c. Cooling coil, wet- and dry-bulb conditions.
    d. Face and bypass damper settings at coils.
    e. Fan drive settings including settings and percentage of maximum pitch diameter.
    f. Inlet vane settings for variable-air-volume systems.
    g. Settings for supply-air, static-pressure controller.
    h. Other system operating conditions that affect performance.

E. System Diagrams: Include schematic layouts of air and hydronic distribution systems. Present each system with single-line diagram and include the following:

1. Quantities of outside, supply, return, and exhaust airflows.
2. Water and steam flow rates.
3. Duct, outlet, and inlet sizes.

4. Pipe and valve sizes and locations.
5. Terminal units.
6. Balancing stations.
7. Position of balancing devices.

F. Roof Top Unit Test Reports: For air-handling units with coils, include the following:

1. Unit Data: Include the following:

a. Unit identification.
b. Location.
c. Make and type.
d. Model number and unit size.
e. Manufacturer's serial number.
f. Unit arrangement and class.
g. Discharge arrangement.
h. Sheave make, size in inches (mm), and bore.
i. Sheave dimensions, center-to-center, and amount of adjustments in inches (mm).
j. Number of belts, make, and size.
k. Number of filters, type, and size.

2. Motor Data:

a. Make and frame type and size.
b. Horsepower and rpm.
c. Volts, phase, and hertz.
d. Full-load amperage and service factor.
e. Sheave make, size in inches (mm), and bore.
f. Sheave dimensions, center-to-center, and amount of adjustments in inches (mm).

3. Test Data (Indicated and Actual Values):

a. Total airflow rate in cfm (L/s).
b. Total system static pressure in inches wg (Pa).
c. Fan rpm.
d. Discharge static pressure in inches wg (Pa).
e. Filter static-pressure differential in inches wg (Pa).
f. Preheat coil static-pressure differential in inches wg (Pa).
g. Cooling coil static-pressure differential in inches wg (Pa).
h. Heating coil static-pressure differential in inches wg (Pa).
i. Outside airflow in cfm (L/s).
j. Return airflow in cfm (L/s).
k. Outside-air damper position.
l. Return-air damper position.
m. Vortex damper position.

G. Apparatus-Coil Test Reports:

1. Coil Data:

a. System identification.
b. Location.
c. Coil type.
d. Number of rows.

e. Fin spacing in fins per inch (mm) o.c.
f. Make and model number.
g. Face area in sq. ft. (sq. m).
h. Tube size in NPS (DN).
i. Tube and fin materials.
j. Circuiting arrangement.

2. Test Data (Indicated and Actual Values):

a. Airflow rate in cfm (L/s).
b. Average face velocity in fpm (m/s).
c. Air pressure drop in inches wg (Pa).
d. Outside-air, wet- and dry-bulb temperatures in deg F (deg C).
e. Return-air, wet- and dry-bulb temperatures in deg F (deg C).
f. Entering-air, wet- and dry-bulb temperatures in deg F (deg C).
g. Leaving-air, wet- and dry-bulb temperatures in deg F (deg C).
h. Refrigerant expansion valve and refrigerant types.
i. Refrigerant suction pressure in psig (kPa).
j. Refrigerant suction temperature in deg F (deg C).

H. Fan Test Reports: For supply, return, and exhaust fans, include the following:

1. Fan Data:

a. System identification.
b. Location.
c. Make and type.
d. Model number and size.
e. Manufacturer's serial number.
f. Arrangement and class.
g. Sheave make, size in inches (mm), and bore.
h. Sheave dimensions, center-to-center, and amount of adjustments in inches (mm).

2. Motor Data:

a. Make and frame type and size.
b. Horsepower and rpm.
c. Volts, phase, and hertz.
d. Full-load amperage and service factor.
e. Sheave make, size in inches (mm), and bore.
f. Sheave dimensions, center-to-center, and amount of adjustments in inches (mm).
g. Number of belts, make, and size.

3. Test Data (Indicated and Actual Values):

a. Total airflow rate in cfm (L/s).
b. Total system static pressure in inches wg (Pa).
c. Fan rpm.
d. Discharge static pressure in inches wg (Pa).
e. Suction static pressure in inches wg (Pa).

3.12 INSPECTIONS

A. Initial Inspection:

1. After testing and balancing are complete, operate each system and randomly check measurements to verify that the system is operating according to the final test and balance readings documented in the Final Report.
2. Randomly check the following for each system:

a. Measure airflow of at least 10 percent of air outlets.
b. Measure water flow of at least 5 percent of terminals.
c. Measure room temperature at each thermostat/temperature sensor. Compare the reading to the set point.
d. Measure sound levels at two locations.
e. Measure space pressure of at least 10 percent of locations.
f. Verify that balancing devices are marked with final balance position.
g. Note deviations to the Contract Documents in the Final Report.

B. Final Inspection:

1. After initial inspection is complete and evidence by random checks verifies that testing and balancing are complete and accurately documented in the final report, request that a final inspection be made by Engineer.
2. TAB firm test and balance engineer shall conduct the inspection in the presence of Engineer.
3. Engineer shall randomly select measurements documented in the final report to be rechecked. The rechecking shall be limited to either 10 percent of the total measurements recorded, or the extent of measurements that can be accomplished in a normal 8-hour business day.
4. If the rechecks yield measurements that differ from the measurements documented in the final report by more than the tolerances allowed, the measurements shall be noted as "FAILED."
5. If the number of "FAILED" measurements is greater than 10 percent of the total measurements checked during the final inspection, the testing and balancing shall be considered incomplete and shall be rejected.
6. TAB firm shall recheck all measurements and make adjustments. Revise the final report and balancing device settings to include all changes and resubmit the final report.
7. Request a second final inspection. If the second final inspection also fails, Owner shall contract the services of another TAB firm to complete the testing and balancing in accordance with the Contract Documents and deduct the cost of the services from the final payment.

3.13 ADDITIONAL TESTS

A. Within 90 days of completing TAB, perform additional testing and balancing to verify that balanced conditions are being maintained throughout and to correct unusual conditions.

B. Seasonal Periods: If initial TAB procedures were not performed during near-peak summer and winter conditions, perform additional testing, inspecting, and adjusting during near-peak summer and winter conditions.

END OF SECTION 15950

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. Electrical equipment coordination and installation.
2. Sleeves for raceways and cables.
3. Sleeve seals.
4. Common electrical installation requirements.

1.3 DEFINITIONS

A. ATS: Acceptance Testing Specifications.

B. EPDM: Ethylene-propylene-diene terpolymer rubber.

C. NBR: Acrylonitrile-butadiene rubber.

1.4 SUBMITTALS

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

1.5 QUALITY ASSURANCE

A. Test Equipment Suitability and Calibration: Comply with NETA ATS, "Suitability of Test Equipment" and "Test Instrument Calibration."

1.6 CODES AND STANDARDS

A. All electrical work and materials and equipment shall comply with the following codes and regulations as applicable:
1. The International Building Code 2012 Edition
2. The International Electric Code NFPA 70 2017 Edition
3. The Electrical Safety Code NFPA 70E
4. The Life Safety Code NFPA 101
5. All requirements of the American Disabilities Act
6. International Energy Code 2009 Edition

7. Requirements of the Authority Having Jurisdiction (AHJ) for the project

B. The contractor shall obtain all permits inspections and approvals as required by the AHJ, and deliver certificates of approval to the owner's representative. All fees and costs incidental to the permits, inspection and approvals shall be paid by the contractor

1.7 COORDINATION

A. Coordinate with other trades the arrange, mounting, and support of electrical equipment as follows:

1. To allow maximum possible headroom unless specific mounting heights that reduce head room are indicated.
2. To provide for ease of disconnecting the equipment with minimum interference to other installations.
3. To allow right of way for piping and conduit installed at required slope.
4. So connecting raceways, cables, wire ways, cable trays, and busways will be clear of obstructions and of the working and access space of other equipment.

B. Coordinate installation of required supporting devices and set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.

C. Coordinate location of access panels and doors for electrical items that are behind finished surfaces or otherwise concealed. Access doors and panels are specified in Division 8 Section "Access Doors and Frames."

D. Coordinate the electrical requirements for equipment provided by other trades with the electrical provisions for such equipment.

E. Coordinate electrical testing of electrical, mechanical, and architectural items, so equipment and systems that are functionally interdependent are tested to demonstrate successful interoperability.

F. Coordinate with the local power company the local telephone company the requirements and additional costs for providing electrical and communication service to the new facility. Additional costs for these utility services shall be included with your bid

1.8 PROJECT CONDITIONS

A. The contractor shall visit the site and examine existing conditions before submitting a bid. No allowance will be made for lack of knowledge of existing conditions when such conditions can be determined by observation.

B. Temporary electrical installation for construction shall be provided as required. All temporary electrical installations shall comply with the requirements of the National Electric Code Article 590.

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. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers listed in the specification and on the drawings.
2. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers listed in the specifications or on the drawings.

2.2 SLEEVES FOR RACEWAYS AND CABLES

A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.

B. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral water stop, unless otherwise indicated.

C. Sleeves for Rectangular Openings: Galvanized sheet steel with minimum 0.052- or 0.138-inch (1.3- or 3.5-mm) thickness as indicated and of length to suit application.

D. Coordinate sleeve selection and application with selection and application of fire stopping specified in Division 7 Section "Through-Penetration Firestop Systems."

2.3 SLEEVE SEALS

A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable.

1. **Available** Manufacturers:

a. Advance Products & Systems, Inc.
b. Calpico, Inc.
c. Metraflex Co.
d. Pipeline Seal and Insulator, Inc.

2. Sealing Elements: **EPDM** interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of raceway or cable.
3. Pressure Plates: **Carbon steel**. Include two for each sealing element.
4. Connecting Bolts and Nuts: **Carbon steel with corrosion-resistant coating** of length required to secure pressure plates to sealing elements. Include one for each sealing element.

PART 3 - EXECUTION

3.1 COMMON REQUIREMENTS FOR ELECTRICAL INSTALLATION

A. Comply with the Standards for Good Workmanship in Electrical Installation NECA 1.

B. The contractor shall assume all costs arranging for required cutting and patching related to his portion of the work. All such work shall be coordinated with other trades and approved by the general contractor.

C. Touch up pant as required for all panelboard raceways and equipment with manufacturer supplied touch up paint.

D. All patching shall be done to match the condition and appearance of the adjacent surfaces

E. Measure indicated mounting heights to bottom of unit for suspended items and to center of unit for wall-mounting items.

F. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom consistent with these requirements.

G. Equipment: Install to facilitate service, maintenance, and repair or replacement of components of both electrical equipment and other nearby installations. Connect in such a way as to facilitate future disconnecting with minimum interference with other items in the vicinity.

H. Right of Way: Give to raceways and piping systems installed at a required slope.

3.2 SLEEVE INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Electrical penetrations occur when raceways, cables, wire ways, cable trays, or busways penetrate concrete slabs, concrete or masonry walls, or fire-rated floor and wall assemblies.

B. Coordinate sleeve selection and application with selection and application of fire stopping specified in Division 7 Section "Through-Penetration Firestop Systems."

C. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.

D. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.

E. Rectangular Sleeve Minimum Metal Thickness:

1. For sleeve cross-section rectangle perimeter less than 50 inches (1270 mm) and no side greater than 16 inches (400 mm), thickness shall be 0.052 inch (1.3 mm).
2. For sleeve cross-section rectangle perimeter equal to, or greater than, 50 inches (1270 mm) and 1 or more sides equal to, or greater than, 16 inches (400 mm), thickness shall be 0.138 inch (3.5 mm).

F. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.

G. Cut sleeves to length for mounting flush with both surfaces of walls.

H. Extend sleeves installed in floors 2 inches (50 mm) above finished floor level.

I. Size pipe sleeves to provide 1/4-inch (6.4-mm) annular clear space between sleeve and raceway or cable unless sleeve seal is to be installed **or unless seismic criteria require a different clearance**].

J. Seal space outside of sleeves with grout for penetrations of concrete and masonry **and with approved joint compound for gypsum board assemblies**.

K. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint. Refer to Division 7 Section "Joint Sealants" for materials and installation.

L. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at raceway and cable penetrations. Install sleeves and seal raceway and cable penetration sleeves with firestop materials. Comply with Division 7 Section "Through-Penetration Firestop Systems."

M. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work and approved by the roofing contractor to comply with roof warranty.

N. Aboveground, Exterior-Wall Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.

O. Underground, Exterior-Wall Penetrations: Install cast-iron "wall pipes" for sleeves. Size sleeves to allow for 1-inch (25-mm) annular clear space between raceway or cable and sleeve for installing mechanical sleeve seals.

3.3 SLEEVE-SEAL INSTALLATION

A. Install to seal underground, exterior wall penetrations.

B. Use type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.4 FIRESTOPPING

A. Apply fire stopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly. Fire stopping materials and installation requirements are specified in Division 7 Section "Through-Penetration Firestop Systems."

3.5 FIELD QUALITY CONTROL

A. Inspect installed sleeve and sleeve-seal installations and associated fire stopping for damage and faulty work.

END OF SECTION 16050

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 methods and materials for grounding systems and equipment**.**
   1. Common ground bonding with lightning protection system.

1.3 SUBMITTALS

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

B. Other Informational Submittals: Plans showing dimensioned as-built locations of grounding features specified in Part 3 "Field Quality Control" Article, including the following:

   1. Test wells.
   2. Ground rods.
   3. Grounding arrangements and connections for separately derived systems.
   4. Stand by electric generator

C. Qualification Data: For testing agency and testing agency's field supervisor.

D. Field quality-control test reports.

E. Operation and Maintenance Data: For grounding to include the following in emergency, operation, and maintenance manuals:

   1. Instructions for periodic testing and inspection of grounding features at **test wells ground rings grounding connections for separately derived systems** .

      a. Tests shall be to determine if ground resistance or impedance values remain within specified maximums, and instructions shall recommend corrective action if they do not.
      b. Include recommended testing intervals.

1.4 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a member company of the Inter

B. National Electrical Testing Association or is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.

1. Testing Agency's Field Supervisor: Person currently certified by the InterNational Electrical Testing Association to supervise on-site testing specified in Part 3.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

D. Comply with UL 467 for grounding and bonding materials and equipment.

PART 2 - PRODUCTS

2.1 CONDUCTORS

A. Insulated Conductors: **Copper or tinned-copper** wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.

B. Bare Copper Conductors:

1. Solid Conductors: ASTM B 3.
2. Stranded Conductors: ASTM B 8.
3. Tinned Conductors: ASTM B 33.
4. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch (6 mm) in diameter.
5. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
6. Bonding Jumper: Copper tape, braided conductors, terminated with copper ferrules; 1-5/8 inches (41 mm) wide and 1/16 inch (1.6 mm) thick.
7. Tinned Bonding Jumper: Tinned-copper tape, braided conductors, terminated with copper ferrules; 1-5/8 inches (41 mm) wide and 1/16 inch (1.6 mm) thick.

C. Bare Grounding Conductor and Conductor Protector for Wood Poles:

1. No. 4 AWG minimum, soft-drawn copper.
2. Conductor Protector: Half-round PVC or wood molding. If wood, use pressure-treated fir or cypress or cedar.

D. Grounding Bus: Rectangular bars of annealed copper, **1/4 by 2 inches (6 by 50 mm)**] in cross section, unless otherwise indicated; with insulators.

2.2 CONNECTORS

A. Listed and labeled by a nationally recognized testing laboratory acceptable to authorities having jurisdiction for applications in which used, and for specific types, sizes, and combinations of conductors and other items connected.

B. Bolted Connectors for Conductors and Pipes: Copper or copper alloy, bolted pressure-type, with at least two bolts.

1. Pipe Connectors: Clamp type, sized for pipe.

C. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

2.3 GROUNDING ELECTRODES

A. Ground Rods: **Copper-clad** steel**, sectional type**; [**3/4 inch** in diameter **by 8 feet (19 mm by 3 m))**].

PART 3 - EXECUTION

3.1 APPLICATIONS

A. Conductors: Install solid conductor for No.**8** AWG and smaller, and stranded conductors for No.**6** AWG and larger, unless otherwise indicated.

B. Underground Grounding Conductors: Install bare **tinned-** copper conductor, No. **2/0 size** AWG minimum.

1. Bury at least 24 inches (600 mm) below grade.

C. Isolated Grounding Conductors: Green-colored insulation with continuous yellow stripe. On feeders with isolated ground, identify grounding conductor where visible to normal inspection, with alternating bands of green and yellow tape, with at least three bands of green and two bands of yellow.

D. Grounding Bus: Install in electrical and telephone equipment rooms, in rooms housing service equipment, and elsewhere as indicated.

1. Install bus on insulated spacers 1 inch (25 mm), minimum, from wall 6 inches (150 mm) above finished floor, unless otherwise indicated.
2. Where indicated on both sides of doorways, route bus up to top of door frame, across top of doorway, down to specified height above floor, and connect to horizontal bus.

E. Conductor Terminations and Connections:

1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
2. Underground Connections: Welded connectors, except at test wells and as otherwise indicated.
3. Connections to Ground Rods at Test Wells: Bolted connectors.
4. Connections to Structural Steel: Welded connectors.

F. Extended from grade level up to and through communication service and transformer spaces.

3.2 EQUIPMENT GROUNDING

A. Install insulated equipment grounding conductors with all feeders and branch circuits.

B. Install insulated equipment grounding conductors with the following items, in addition to those required by NFPA 70:

1. Feeders and branch circuits.
2. Lighting circuits.
3. Receptacle circuits.
4. Single-phase motor and appliance branch circuits.

5. Three-phase motor and appliance branch circuits.
6. Flexible raceway runs.
7. Armored and metal-clad cable runs.
8. Busway Supply Circuits: Install insulated equipment grounding conductor from grounding bus in the switchgear, switchboard, or distribution panel to equipment grounding bar terminal on busway.
9. Computer and Rack-Mounted Electronic Equipment Circuits: Install insulated equipment grounding conductor in branch-circuit runs from equipment-area power panels and power-distribution units.
10. X-Ray Equipment Circuits: Install insulated equipment grounding conductor in circuits supplying x-ray equipment.

C. Air-Duct Equipment Circuits: Install insulated equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners, heaters, dampers, humidifiers, and other duct electrical equipment. Bond conductor to each unit and to air duct and connected metallic piping.

D. Water Heater, Heat-Tracing, and Antifrost Heating Cables: Install a separate insulated equipment grounding conductor to each electric water heater and heat-tracing cable. Bond conductor to heater units, piping, connected equipment, and components.

E. Isolated Grounding Receptacle Circuits: Install an insulated equipment grounding conductor connected to the receptacle grounding terminal. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service, unless otherwise indicated.

F. Isolated Equipment Enclosure Circuits: For designated equipment supplied by a branch circuit or feeder, isolate equipment enclosure from supply circuit raceway with a nonmetallic raceway fitting listed for the purpose. Install fitting where raceway enters enclosure, and install a separate insulated equipment grounding conductor. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service, unless otherwise indicated.

G. Signal and Communication Equipment: For telephone, alarm, voice and data, and other communication equipment, provide No. 4 AWG minimum insulated grounding conductor in raceway from grounding electrode system to each service location, terminal cabinet, wiring closet, and central equipment location.

1. Service and Central Equipment Locations and Wiring Closets: Terminate grounding conductor on a 1/4-by-2-by-12-inch (6-by-50-by-300-mm) grounding bus.
2. Terminal Cabinets: Terminate grounding conductor on cabinet grounding terminal.

3.3 INSTALLATION

A. Grounding Conductors: Route along shortest and straightest paths possible, unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.

B. Common Ground Bonding with Lightning Protection System: Comply with NFPA 780 and UL 96 when interconnecting with lightning protection system. Bond electrical power system ground directly to lightning protection system grounding conductor at closest point to electrical service grounding electrode. Use bonding conductor sized same as system grounding electrode conductor, and install in conduit.

C. Ground Rods: Drive rods until tops are 2 inches (50 mm) below finished floor or final grade, unless otherwise indicated.

1. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating, if any.
2. For grounding electrode system, install at least [**three**] <**Insert number**> rods spaced at least one-rod length from each other and located at least the same distance from other grounding electrodes, and connect to the service grounding electrode conductor.

D. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance, except where routed through short lengths of conduit.

1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install so vibration is not transmitted to rigidly mounted equipment.
3. Use exothermic-welded connectors for outdoor locations, but if a disconnect-type connection is required, use a bolted clamp.

E. Grounding and Bonding for Piping:

1. Metal Water Service Pipe: Install insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes, using a bolted clamp connector or by bolting a lug-type connector to a pipe flange, using one of the lug bolts of the flange. Where a dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.
2. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with a bolted connector.
3. Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.

F. Bonding Interior Metal Ducts: Bond metal air ducts to equipment grounding conductors of associated fans, blowers, electric heaters, and air cleaners. Install **tinned** bonding jumper to bond across flexible duct connections to achieve continuity.

G. Grounding for Steel Building Structure: Install a driven ground rod at base of each corner column and at intermediate exterior columns at distances not more than 60 feet (18 m) apart.

H. Ground Ring: Install a grounding conductor, electrically connected to each building structure ground rod and to each **steel column**, extending around the perimeter of **building**.

1. Install tinned-copper conductor not less than No. **2/0** AWG for ground ring and for taps to building steel.
2. Bury ground ring not less than **24 inches (600 mm)** from building foundation.

I. Ufer Ground (Concrete-Encased Grounding Electrode): Fabricate according to NFPA 70, using a minimum of **20 feet (6 m)** of bare copper conductor not smaller than No. **4** AWG.

1. If concrete foundation is less than **20 feet (6 m)**long, coil excess conductor within base of foundation.

2. Bond grounding conductor to reinforcing steel in at least four locations and to anchor bolts. Extend grounding conductor below grade and connect to building grounding grid or to grounding electrode external to concrete.

3.4 FIELD QUALITY CONTROL

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

B. Testing Agency: Engage a qualified testing and inspecting agency to perform the following field tests and inspections and prepare test reports:

C. Perform the following tests and inspections and prepare test reports:

1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
2. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal**, at ground test wells, and at individual ground rods**. Make tests at ground rods before any conductors are connected.

    a. Measure ground resistance not less than two full days after last trace of precipitation and without soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.
    b. Perform tests by fall-of-potential method according to IEEE 81.

3. Prepare dimensioned drawings locating each test well, ground rod and ground rod assembly, and other grounding electrodes. Identify each by letter in alphabetical order, and key to the record of tests and observations. Include the number of rods driven and their depth at each location, and include observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results.

D. Report measured ground resistances that exceed the following values:

1. Power and Lighting Equipment or System with Capacity 500 kVA and Less: **10** ohms.
2. Power and Lighting Equipment or System with Capacity 500 to 1000 kVA: **5** ohms.
3. Power and Lighting Equipment or System with Capacity More Than 1000 kVA: **3** ohms.
4. Power Distribution Units or Panelboards Serving Electronic Equipment: **1**] ohm(s).

E. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and include recommendations to reduce ground resistance.

END OF SECTION 16060

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. Hangers and supports for electrical equipment and systems.
2. Seismic restraints for electrical equipment and systems.
3. Construction requirements for concrete bases.

1.3 DEFINITIONS

A. EMT: Electrical metallic tubing.

B. IBC: International Building Code.

C. IMC: Intermediate metal conduit.

D. NBC: National Building Code.

E. OSHPD: Office of Statewide Health Planning and Development.

F. RMC: Rigid metal conduit.

G. SBC: Standard Building Code.

H. Seismic Restraint: A structural support element such as a metal framing member, a cable, an anchor bolt or stud, a fastening device, or an assembly of these items used to transmit seismic forces from an item of equipment or system to building structure and to limit movement of item during a seismic event.

I. UBC: Uniform Building Code.

1.4 SUBMITTALS

A. Product Data: Illustrate and indicate style, material, strength, fastening provision, and finish for each type and size of electrical support **and seismic-restraint** component used.

1. Tabulate types and sizes of seismic restraints, complete with report numbers and rated strength in tension and shear as evaluated by **an evaluation service member of the ICC Evaluation Program to authorities having jurisdiction**].

2. Annotate to indicate application of each product submitted and compliance with requirements.

B. Shop Drawings: Indicate materials and dimensions and identify hardware, including attachment and anchorage devices, signed and sealed by a qualified professional engineer. Professional engineer qualification requirements are specified in Division 1 Section "Quality Requirements." Include the following:

1. Fabricated Supports: Representations of field-fabricated supports not detailed on Drawings.
2. Seismic Restraints: Detail anchorage and bracing not defined by details or charts on Drawings. Include the following:

a. Design Analysis: To support selection and arrangement of seismic restraints. Include calculations of combined tensile and shear loads.
b. Details: Detail fabrication and arrangement. Detail attachments of restraints to the restrained items and to the structure. Show attachment locations, methods, and spacing. Identify components, list their strengths, and indicate directions and values of forces transmitted to the structure during seismic events.

C. Coordination Drawings: Show coordination of seismic bracing for electrical components with other systems and equipment in the vicinity, including other supports and seismic restraints.

D. Welding certificates where applicable.

E. Qualification Data: For **professional engineer and testing agency where applicable**.

F. Field quality-control test reports.

1.5 QUALITY ASSURANCE

A. Comply with seismic-restraint requirements in the **IBC** unless requirements in this Section are more stringent.

B. Testing of Seismic Anchorage Devices: Comply with testing requirements in Part 3 and in Division 16 Section "Electrical Supports and Seismic Restraints."

C. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

1.6 PROJECT CONDITIONS

A. Site Class as Defined in the IBC: **A**.

B. S_s, Mapped Maximum Considered Earthquake Spectral Response at Short Periods: <**Insert mapped value for Project site from IBC Figures 1615(1) through 1615(15).**>

C. S_1, Mapped Maximum Considered Earthquake Spectral Response at 1-Second Period: <**Insert mapped value for Project site from IBC Figures 1615(1) through 1615(15).**>

D. Assigned Seismic Use Group or Building Category as Defined in the IBC: **II**.

1.7 PROJECT CONDITIONS

A. Project Seismic Zone as Defined in the UBC: Zone **1**

B. Project Seismic Zone Factor as Defined in the UBC: Zone Factor [**0.075**] [**0.15**] [**0.20**] [**0.30**] [**0.40**].

C. Occupancy Category as Defined in the UBC: **II**.

1.8 PROJECT CONDITIONS

A. Soil Profile Type: <**Insert value.**>

B. Acceleration Factor as Defined in the NBC: <**Insert value.**>

C. Project Seismic Hazard Exposure Group as Defined in the NBC: [**I**] [**II**] [**III**].

1.9 PROJECT CONDITIONS

A. Soil Profile Type: <**Insert value.**>

PART 2 - PRODUCTS

2.1 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

A. Rated Strength: Adequate in tension, shear, and pullout force to resist maximum loads calculated or imposed under this Project, with a minimum structural safety factor of **five** times the applied force.

B. Steel Slotted Support Systems: Comply with MFMA-3, factory-fabricated components for field assembly.

1. **Available** Manufacturers:

a. Cooper B-Line; a division of Cooper Industries.
b. ERICO International Corporation.
c. Allied Support Systems; Power-Strut Unit.
d. GS Metals Corp.
e. Michigan Hanger Co., Inc.; O-Strut Div.
f. National Pipe Hanger Corp.
g. Thomas & Betts Corporation.
h. Unistrut; Tyco International, Ltd.
i. Wesanco, Inc.

2. Finishes:

a. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-3.

b. Nonmetallic Coatings: Manufacturer's standard PVC, polyurethane, or polyester coating applied according to MFMA-3.
c. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-3.

3. Channel Dimensions: Selected for structural loading[**and applicable seismic forces**].

C. Nonmetallic Slotted Support Systems: Structural-grade, factory-formed, glass-fiber-resin channels and angles with 9/16-inch- (14-mm-) diameter holes at a maximum of 8 inches (200 mm) O.C., in at least 1 surface.

1. **Available** Manufacturers:

a. Allied Support Systems; Aickinstrut Unit.
b. Cooper B-Line; a division of Cooper Industries.
c. Fabco Plastics Wholesale Limited.
d. Seasafe, Inc.

2. Or equal Fittings and Accessories: Products of channel and angle manufacturer and designed for use with those items.
3. Fitting and Accessory Materials: Same as channels and angles**, except metal items may be stainless steel**.
4. Rated Strength: Selected to suit structural loading[**and applicable seismic forces**].

D. Raceway and Cable Supports: As described in NECA 1.

E. Conduit and Cable Support Devices: **Steel and malleable-iron** hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.

F. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for non-armored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be malleable iron.

G. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

H. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:

1. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened Portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.

a. **Available** Manufacturers:

1) Hilti, Inc.
2) ITW Construction Products.
3) MKT Fastening, LLC.
4) Simpson Strong-Tie Co. Inc.
5) Or equal

2. Mechanical-Expansion Anchors: Insert-wedge-type, **zinc-coated** steel, for use in hardened Portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials in which used.

    a. **Available** Manufacturers:

        1) Cooper B-Line; a division of Cooper Industries.
        2) Empire Tool and Manufacturing Co., Inc
        3) Hilti, Inc.
        4) ITW Construction Products.
        5) MKT Fastening, LLC.
        6) Powers Fasteners.

3. Concrete Inserts: Steel or malleable-iron slotted-support-system units similar to MSS Type 18; complying with MFMA-3 or MSS SP-58.
4. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.
5. Through Bolts: Structural type, hex head, high strength. Comply with ASTM A 325.
6. Toggle Bolts: All-steel springhead type.
7. Hanger Rods: Threaded steel.

2.2 SEISMIC-RESTRAINT COMPONENTS

A. Rated Strength, Features, and Application Requirements for Restraint Components: As defined in reports by **an evaluation service member of the ICC Evaluation Service Program**.

1. Structural Safety Factor: Strength in tension, shear, and pullout force of components used shall be at least **five** times the maximum seismic forces to which they will be subjected.

B. Angle and Channel-Type Brace Assemblies: Steel angles or steel slotted-support-system components; with accessories for attachment to braced component at one end and to building structure at the other end.

C. Cable Restraints: ASTM A 603, zinc-coated, steel wire rope attached to steel or stainless-steel thimbles, brackets, swivels, and bolts designed for restraining cable service.

1. **Available** Manufacturers:

    a. Amber/Booth Company, Inc.
    b. Loos & Co., Inc.
    c. Mason Industries, Inc.

2. Seismic Mountings, Anchors, and Attachments: Devices as specified in Part 2 "Support, Anchorage, and Attachment Components" Article, selected to resist seismic forces.
3. Hanger Rod Stiffener: **Steel tube or steel slotted-support-system sleeve with internally bolted connections**.
4. Bushings for Floor-Mounted Equipment Anchors: Neoprene units designed for seismically rated rigid equipment mountings, and matched to type and size of anchor bolts and studs used.

5. Bushing Assemblies for Wall-Mounted Equipment Anchorage: Assemblies of neoprene elements and steel sleeves designed for seismically rated rigid equipment mountings, and matched to type and size of attachment devices used.

2.3 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

A. Description: Welded or bolted, structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.

B. Materials: Comply with requirements in Division 5 Section "Metal Fabrications" for steel shapes and plates.

PART 3 - EXECUTION

3.1 APPLICATION

A. Comply with NECA 1 for application of hangers and supports for electrical equipment and systems, except if requirements in this Section are stricter.

B. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMT, IMC, and RMC as **scheduled in NECA 1, where Table 1 lists maximum spacing less than stated in** NFPA 70. Minimum rod size shall be 1/4 inch (6 mm) in diameter.

C. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted [**or other**]support system, sized so capacity can be increased by at least [**25**] <**Insert number**> percent in future without exceeding specified design load limits.

1. Secure raceways and cables to trapeze member with clamps approved for application by [**an evaluation service member of the ICC Evaluation Program** or **an agency acceptable to authorities having jurisdiction**
2. Secure raceways and cables to these supports with **two-bolt conduit clamps**

D. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2-inch (38-mm) and smaller raceways serving branch circuits and communication systems above suspended ceilings and for fastening raceways to trapeze supports.

3.2 SUPPORT **AND SEISMIC-RESTRAINT** INSTALLATION

A. Comply with NECA 1 for installation requirements, except as specified in this Article.

B. Raceway Support Methods: In addition to methods described in NECA 1, **EMT, IMC, and RMC** may be supported by openings through structure members, as permitted in NFPA 70.

C. Install seismic-restraint components using methods approved by the evaluation service providing required submittals for component.

D. Strength of Support **and Seismic-Restraint** Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static **and seismic** loads

within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb (90 kg).

E. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:

1. To Wood: Fasten with lag screws or through bolts.
2. To New Concrete: Bolt to concrete inserts.
3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
4. To Existing Concrete: Expansion anchor fasteners.
5. Instead of expansion anchors, powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete 4 inches (100 mm) thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inches (100 mm) thick.
6. To Steel: **Welded threaded studs complying with AWS D1.1/D1.1M, with lock washers and nuts**
7. To Light Steel: Sheet metal screws.
8. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate **by means that meet seismic-restraint strength and anchorage requirements**.

F. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.

3.3 INSTALLATION OF FABRICATED METAL SUPPORTS

A. Comply with installation requirements in Division 5 Section "Metal Fabrications" for site-fabricated metal supports.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.

C. Field Welding: Comply with AWS D1.1/D1.1M.

3.4 CONCRETE BASES

A. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions and seismic criteria at Project.

B. Construct concrete bases of dimensions indicated but not less than 4 inches (100 mm) larger in both directions than supported unit, and so expansion anchors will be a minimum of 10 bolt diameters from edge of the base.

1. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around full perimeter of the base.

2. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.

3. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
4. Install anchor bolts to elevations required for proper attachment to supported equipment.
5. Install anchor bolts according to anchor-bolt manufacturer's written instructions.
6. Use **3000-psi (20.7-MPa)**, 28-day compressive-strength concrete. Concrete materials, reinforcement, and placement requirements are specified in Division 3 Section "**Cast-in-Place Concrete**."

3.5 INSTALLATION OF SEISMIC-RESTRAINT COMPONENTS

A. Install bushing assemblies for anchor bolts for floor-mounted equipment, arranged to provide resilient media between anchor bolt and mounting hole in concrete base.

B. Install bushing assemblies for mounting bolts for wall-mounted equipment, arranged to provide resilient media where equipment or equipment-mounting channels are attached to wall.

C. Restraint Cables: Provide slack within maximums recommended by manufacturer.

D. Attachment to Structure: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, upper truss chords of bar joists, or at concrete members.

3.6 ACCOMMODATION OF DIFFERENTIAL SEISMIC MOTION

A. Make flexible connections in runs of raceways, cables, wire ways, cable trays, and busways where they cross expansion and seismic-control joints, where adjacent sections or branches are supported by different structural elements, and where they terminate with connection to electrical equipment that is anchored to a different structural element from the one supporting them as they approach equipment.

3.7 FIELD QUALITY CONTROL

A. Testing Agency: **Engage** a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. Testing: Test pullout resistance of seismic anchorage devices.

1. Provide evidence of recent calibration of test equipment by a testing agency acceptable to authorities having jurisdiction.
2. Schedule test with Owner, through Architect, before connecting anchorage device to restrained component (unless post connection testing has been approved), and with at least seven days' advance notice.
3. Obtain Architect's approval before transmitting test loads to structure. Provide temporary load-spreading members.
4. Test at least [**four**] <**insert number**> of each type and size of installed anchors and fasteners selected by Architect.
5. Test to 90 percent of rated proof load of device.

6. If a device fails test, modify all installations of same type and retest until satisfactory results are achieved.

C. Record test results.

END OF SECTION 16072

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. Identification for raceway and metal-clad cable.
2. Identification for conductors and communication and control cable.
3. Underground-line warning tape.
4. Warning labels and signs.
5. Instruction signs.
6. Equipment identification labels.
7. Miscellaneous identification products.

1.3 SUBMITTALS

A. Product Data: For each electrical identification product indicated.

B. Identification Schedule: An index of nomenclature of electrical equipment and system components used in identification signs and labels.

C. Samples: For each type of label and sign to illustrate size, colors, lettering style, mounting provisions, and graphic features of identification products.

1.4 QUALITY ASSURANCE

A. Comply with ANSI A13.1 and ANSI C2.

B. Comply with NFPA 70.

C. Comply with 29 CFR 1910.145.

1.5 COORDINATION

A. Coordinate identification names, abbreviations, colors, and other features with requirements in the Contract Documents, Shop Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual, and with those required by codes, standards, and 29 CFR 1910.145. Use consistent designations throughout Project.

B. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

C. Coordinate installation of identifying devices with location of access panels and doors.

D. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 RACEWAY AND METAL-CLAD CABLE IDENTIFICATION MATERIALS

A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway and cable size.

B. Color for Printed Legend:

1. Power Circuits: Black letters on an orange field.
2. <**Insert systems and assigned colors.**>
3. Legend: Indicate system or service and voltage, if applicable.

C. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.

D. Snap-Around Labels: Slit, pre-tensioned, flexible, preprinted, color-coded acrylic sleeves, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

E. Snap-Around, Color-Coding Bands: Slit, pre-tensioned, flexible, solid-colored acrylic sleeves, 2 inches (50 mm) long, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

F. Self-Adhesive Vinyl Tape: Colored, heavy duty, waterproof, fade resistant; 2 inches (50 mm) wide; compounded for outdoor use.

2.2 CONDUCTOR COMMUNICATION AND CONTROL-CABLE IDENTIFICATION MATERIALS

A. Color-Coding Conductor Tape: Colored, self-adhesive vinyl tape not less than 3 mils (0.08 mm) thick by 1 to 2 inches (25 to 50 mm) wide.

B. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.

C. Aluminum Wraparound Marker Labels: Cut from 0.014-inch- (0.35-mm-) thick aluminum sheet, with stamped, embossed, or scribed legend, and fitted with tabs and matching slots for permanently securing around wire or cable jacket or around groups of conductors.

D. Metal Tags: Brass or aluminum, 2 by 2 by 0.05 inch (50 by 50 by 1.3 mm), with stamped legend, punched for use with self-locking nylon tie fastener.

E. Write-On Tags: Polyester tag, [**0.010 inch (0.25 mm)**] [**0.015 inch (0.38 mm)**] <**Insert thickness**> thick, with corrosion-resistant grommet and polyester or nylon tie for attachment to conductor or cable.

1. Marker for Tags: Permanent, waterproof, black ink marker recommended by tag manufacturer.

2.3 UNDERGROUND-LINE WARNING TAPE

A. Description: Permanent, bright-colored, continuous-printed, polyethylene tape.

1. Not less than 6 inches (150 mm) wide by 4 mils (0.102 mm) thick.
2. Compounded for permanent direct-burial service.
3. Embedded continuous metallic strip or core.
4. Printed legend shall indicate type of underground line.

2.4 WARNING LABELS AND SIGNS

A. Comply with NFPA 70 and 29 CFR 1910.145.

B. Self-Adhesive Warning Labels: Factory printed, multicolor, pressure-sensitive adhesive labels, configured for display on front cover, door, or other access to equipment, unless otherwise indicated.

C. Baked-Enamel Warning Signs: Preprinted aluminum signs, punched or drilled for fasteners, with colors, legend, and size required for application. 1/4-inch (6.4-mm) grommets in corners for mounting. Nominal size, 7 by 10 inches (180 by 250 mm).

D. Metal-Backed, Butyrate Warning Signs: Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate signs with 0.0396-inch (1-mm) galvanized-steel backing; and with colors, legend, and size required for application. 1/4-inch (6.4-mm) grommets in corners for mounting. Nominal size, 10 by 14 inches (250 by 360 mm).

E. Warning label and sign shall include, but are not limited to, the following legends:

1. Multiple Power Source Warning: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."
2. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 inches (915 MM)."
3. <**Insert names and wording of additional warning signs or labels.**>

2.5 INSTRUCTION SIGNS

A. Engraved, laminated acrylic or melamine plastic, minimum 1/16 inch (1.6 mm) thick for signs up to 20 sq. in. (129 sq. cm) and 1/8 inch (3.2 mm) thick for larger sizes.

1. Engraved legend with [**black letters on white face**] <**Insert colors**>.
2. Punched or drilled for mechanical fasteners.
3. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.

2.6 EQUIPMENT IDENTIFICATION LABELS

A. Adhesive Film Label: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch (10 mm).

B. Adhesive Film Label with Clear Protective Overlay: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch (10 mm). Overlay shall provide a weatherproof and ultraviolet-resistant seal for label.

C. Self-Adhesive, Engraved, Laminated Acrylic or Melamine Label: Adhesive backed, with white letters on a dark-gray background. Minimum letter height shall be 3/8 inch (10 mm).

D. Engraved, Laminated Acrylic or Melamine Label: Punched or drilled for screw mounting. White letters on a dark-gray background. Minimum letter height shall be 3/8 inch (10 mm).

2.7 MISCELLANEOUS IDENTIFICATION PRODUCTS

A. Cable Ties: Fungus-inert, self-extinguishing, 1-piece, self-locking, Type 6/6 nylon cable ties.

1. Minimum Width: 3/16 inch (5 mm).
2. Tensile Strength: 50 lb (22.6 kg), minimum.
3. Temperature Range: Minus 40 to plus 185 deg F (Minus 40 to plus 85 deg C).
4. Color: Black, except where used for color-coding.

B. Paint: Paint materials and application requirements are specified in Division 9 painting Sections.

1. Exterior Concrete Unit Masonry:

a. Semi-gloss Acrylic-Enamel Finish: **Two** finish coat(s) over a block filler.

1) Block Filler: Concrete unit masonry block filler.
2) Finish Coats: Exterior semi-gloss acrylic enamel.

2. Exterior Ferrous Metal:

a. Semi-gloss Alkyd-Enamel Finish: **Two** finish coat(s) over a primer.

1) Primer: Exterior ferrous-metal primer.
2) Finish Coats: Exterior semi-gloss alkyd enamel.

3. Exterior Zinc-Coated Metal (except Raceways):

a. Semigloss Alkyd-Enamel Finish: [**One**] [**Two**] <**Insert number**> finish coat(s) over a primer.

1) Primer: Exterior zinc-coated metal primer.
2) Finish Coats: Exterior semigloss alkyd enamel.

4. Interior Concrete Unit Masonry:

a. Semi-gloss Acrylic-Enamel Finish: **One** finish coat(s) over a block filler.

1) Block Filler: Concrete unit masonry block filler.
2) Finish Coats: Interior semi-gloss acrylic enamel.

5. Interior Ferrous Metal:

a. Semi-gloss Acrylic-Enamel Finish: **One** finish coat(s) over a primer.

1) Primer: Interior ferrous-metal primer.
2) Finish Coats: Interior semi-gloss acrylic enamel.

6. Interior Zinc-Coated Metal (except Raceways):

a. Semigloss Acrylic-Enamel Finish: [**One**] [**Two**] <**Insert number**> finish coat(s) over a primer.

1) Primer: Interior zinc-coated metal primer.
2) Finish Coats: Interior semigloss acrylic enamel.

C. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

PART 3 - EXECUTION

3.1 APPLICATION

A. Raceways and Duct Banks More Than 600 V Concealed within Buildings: 4-inch- (100-mm-) wide black stripes on 10-inch (250-mm) centers over orange background that extends full length of raceway or duct and is 12 inches (300 mm) wide. Stencil legend "DANGER CONCEALED HIGH VOLTAGE WIRING" with 3-inch- (75-mm-) high black letters on 20-inch (500-mm) centers. Stop stripes at legends. Apply to the following finished surfaces:

1. Floor surface directly above conduits running beneath and within 12 inches (300 mm) of a floor that is in contact with earth or is framed above unexcavated space.
2. Wall surfaces directly external to raceways concealed within wall.
3. Accessible surfaces of concrete envelope around raceways in vertical shafts, exposed in the building, or concealed above suspended ceilings.

B. Accessible Raceways and Metal-Clad Cables More Than 600 V: Identify with "DANGER-HIGH VOLTAGE" in black letters at least 2 inches (50 mm) high, with **snap-around labels**

C. . Repeat legend at 10-foot (3-m) maximum intervals.

D. Accessible Raceways and Metal-Clad Cables, 600 V or Less, for Service, Feeder, and Branch Circuits More Than **30 A** : Identify with orange **snap-around label**.

E. Accessible Raceways and Cables of Auxiliary Systems: Identify the following systems with color-coded, **snap-around, color-coding bands**:

1. Fire Alarm System: Red.
2. Fire-Suppression Supervisory and Control System: Red and yellow.
3. Combined Fire Alarm and Security System: Red and blue.

4. Security System: Blue and yellow.
5. Mechanical and Electrical Supervisory System: Green and blue.
6. Telecommunication System: Green and yellow.
7. Control Wiring: Green and red.

F. Power-Circuit Conductor Identification: For **primary and secondary** conductors No. **1/0** AWG and larger in vaults, pull and junction boxes, manholes, and hand holes use **aluminum wraparound marker labels**. Identify source and circuit number of each set of conductors. For single conductor cables, identify phase in addition to the above.

G. Branch-Circuit Conductor Identification: Where there are conductors for more than three branch circuits in same junction or pull box, use **color-coding conductor tape**. Identify each ungrounded conductor according to source and circuit number.

H. Conductors to Be Extended in the Future: Attach **write-on tags** to conductors and list source and circuit number.

I. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, signal, sound, intercommunications, voice, and data connections.

1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.
2. Use system of marker tape designations that is uniform and consistent with system used by manufacturer for factory-installed connections.
3. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and Operation and Maintenance Manual.

J. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Comply with 29 CFR 1910.145 and apply **baked-enamel warning sign**. Identify system voltage with black letters on an orange background. Apply to exterior of door, cover, or other access.

1. Equipment with Multiple Power or Control Sources: Apply to door or cover of equipment including, but not limited to, the following:

   a. Power transfer switches.
   b. Controls with external control power connections.

2. Equipment Requiring Workspace Clearance According to NFPA 70: Unless otherwise indicated, apply to door or cover of equipment but not on flush panelboards and similar equipment in finished spaces.

K. Instruction Signs:

1. Operating Instructions: Install instruction signs to facilitate proper operation and maintenance of electrical systems and items to which they connect. Install instruction signs with approved legend where instructions are needed for system or equipment operation.
2. Emergency Operating Instructions: Install instruction signs with white legend on a red background with minimum 3/8-inch- (10-mm-) high letters for emergency instructions at equipment used for **power transfer load shedding** .

L. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and Operation and Maintenance Manual.

Apply labels to disconnect switches and protection equipment, central or master units, control panels, control stations, terminal cabinets, and racks of each system. Systems include power, lighting, control, communication, signal, monitoring, and alarm systems unless equipment is provided with its own identification.

1. Labeling Instructions:

   a. Indoor Equipment: **Engraved, laminated acrylic or melamine label**. Unless otherwise indicated, provide a single line of text with 1/2-inch- (13-mm-) high letters on 1-1/2-inch- (38-mm-) high label; where 2 lines of text are required, use labels 2 inches
   b. Elevated Components: Increase sizes of labels and letters to those appropriate for viewing from the floor.

2. Equipment to Be Labeled:

   a. Panelboards, electrical cabinets, and enclosures.
   b. Access doors and panels for concealed electrical items.
   c. Electrical switchgear and switchboards.
   d. Transformers.
   e. Emergency system boxes and enclosures.
   f. Disconnect switches.
   g. Motor starters.
   h. Push-button stations.
   i.
   j. Contactors.
   k. Remote-controlled switches, dimmer modules, and control devices.
   l.
   m. .
   n. Voice and data cable terminal equipment.
   o. .
   p.
   q. Fire-alarm control panel and annunciators.
   r. Security and intrusion-detection control stations, control panels, terminal cabinets, and racks.
   s. Monitoring and control equipment.

3.2 INSTALLATION

A. Verify identity of each item before installing identification products.

B. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.

C. Apply identification devices to surfaces that require finish after completing finish work.

D. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.

E. Attach non adhesive signs and plastic labels with screws and auxiliary hardware appropriate to the location and substrate.

F. System Identification Color Banding for Raceways and Cables: Each color band shall completely encircle cable or conduit. Place adjacent bands of two-color markings in contact, side by side. Locate bands at changes in direction, at penetrations of walls and floors, at 50-foot (15-m) maximum intervals in straight runs, and at 25-foot (7.6-m) maximum intervals in congested areas.

G. Color-Coding for Phase **and Voltage Level** Identification, 600 V and Less: Use the colors listed below for ungrounded **service, feeder, and branch-circuit** conductors.

1. Color shall be **factory applied or, for sizes larger than No. 10 AWG if authorities having jurisdiction permit, field applied**.
2. Colors for 208/120-V Circuits:

    a. Phase A: Black.
    b. Phase B: Red.
    c. Phase C: Blue.

3. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches (150 mm) from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.

H. Aluminum Wraparound Marker Labels and Metal Tags: Secure tight to surface of conductor or cable at a location with high visibility and accessibility.

I. Underground-Line Warning Tape: During backfilling of trenches install continuous underground-line warning tape directly above line at 6 to 8 inches (150 to 200 mm) below finished grade. Use multiple tapes where width of multiple lines installed in a common trench [**or concrete envelope** exceeds 16 inches (400 mm) overall.

J. Painted Identification: Prepare surface and apply paint according to Division 9 painting Sections.

END OF SECTION 16075

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. Building wires and cables rated 600 V and less.
2. Connectors, splices, and terminations rated 600 V and less.
3. Sleeves and sleeve seals for cables.

B. Related Sections include the following:

1. Division 16 Section "Voice and Data Communication Cabling" for cabling used for voice and data circuits.
2.

1.3 DEFINITIONS

A. EPDM: Ethylene-propylene-diene terpolymer rubber.

B. NBR: Acrylonitrile-butadiene rubber.

1.4 SUBMITTALS

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

B. Qualification Data: For testing agency.

C. Field quality-control test reports.

1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a member company of the InterNational Electrical Testing Association or is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.

1. Testing Agency's Field Supervisor: Person currently certified by the InterNational Electrical Testing Association or the National Institute for Certification in Engineering Technologies to supervise on-site testing specified in Part 3.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Comply with NFPA 70.

1.6 COORDINATION

A. Set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.

PART 2 - PRODUCTS

2.1 CONDUCTORS AND CABLES

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:

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

1. Alcan Products Corporation; Alcan Cable Division.
2. American Insulated Wire Corp.; a Leviton Company.
3. General Cable Corporation.
4. Senator Wire & Cable Company.
5. Southwire Company.

C. **Copper** Conductors: Comply with NEMA WC 70.

D. Conductor Insulation: Comply with NEMA WC 70 for Types **THHN-THWN**, **XHHW and SO**.

E. Multi-conductor Cable: Comply with NEMA WC 70 for **armored cable, Type AC metal-clad cable, Type SO** with ground wire.

2.2 CONNECTORS AND SPLICES

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:

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

1. AFC Cable Systems, Inc.
2. Hubbell Power Systems, Inc.
3. O-Z/Gedney; EGS Electrical Group LLC.
4. 3M; Electrical Products Division.
5. Tyco Electronics Corp.

C. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

2.3 SLEEVES FOR CABLES

A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.

B. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral water stop, unless otherwise indicated.

C. Sleeves for Rectangular Openings: Galvanized sheet steel with minimum 0.052- or 0.138-inch (1.3- or 3.5-mm) thickness as indicated and of length to suit application.

D. Coordinate sleeve selection and application with selection and application of fire stopping specified in Division 7 Section "Through-Penetration Firestop Systems."

2.4 SLEEVE SEALS

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:

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

C. Basis-of-Design Product: Subject to compliance with requirements, provide a comparable product by one of the following:

1. Advance Products & Systems, Inc.
2. Calpico, Inc.
3. Metraflex Co.
4. Pipeline Seal and Insulator, Inc.

D. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and cable.

1. Sealing Elements: **EPDM** interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of raceway or cable.
2. Pressure Plates: **Carbon steel** Include two for each sealing element.
3. Connecting Bolts and Nuts: **Carbon steel with corrosion-resistant coating** of length required to secure pressure plates to sealing elements. Include one for each sealing element.

PART 3 - EXECUTION

3.1 CONDUCTOR MATERIAL APPLICATIONS

A. Feeders: **Copper**. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

B. Branch Circuits: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

A. Exposed Feeders: **Type THHN-THWN, conductors in raceway**.

B. Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspaces: **Type THHN-THWN, single conductors in raceway**

C. Feeders Concealed in Concrete, below Slabs-on-Grade, and Underground: **Type THHN-THWN, single conductors in raceway**.

D. Exposed Branch Circuits: **Type THHN-THWN, single conductors in raceway.**

E. Branch Circuits Concealed in Ceilings, Walls, and Partitions: **Type THHN-THWN, single conductors in raceway**.

F. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground: **Type THHN-THWN, single conductors in raceway**.

G. Class 1 Control Circuits: Type THHN-THWN, in raceway.

H. Class 2 Control Circuits: **Type THHN-THWN, in raceway**, **Power-limited cable, concealed in building finishes**.

3.3 INSTALLATION OF CONDUCTORS AND CABLES

A. Conceal cables in finished walls, ceilings, and floors, unless otherwise indicated.

B. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.

C. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.

D. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.

E. Support cables according to Division 16 Section "Electrical Supports and Seismic Restraints."

F. Identify and color-code conductors and cables according to Division 16 Section "Electrical Identification."

3.4 CONNECTIONS

A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

B. Make splices and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than un-spliced conductors.

1. Use oxide inhibitor in each splice and tap conductor for aluminum conductors.

C. Wiring at Outlets: Install conductor at each outlet, with at least **6 inches (150 mm)** of slack.

3.5 SLEEVE INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Coordinate sleeve selection and application with selection and application of fire stopping specified in Division 7 Section "Through-Penetration Firestop Systems."

B. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.

C. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.

D. Rectangular Sleeve Minimum Metal Thickness:

1. For sleeve rectangle perimeter less than 50 inches (1270 mm) and no side greater than 16 inches (400 mm), thickness shall be 0.052 inch (1.3 mm).
2. For sleeve rectangle perimeter equal to, or greater than, 50 inches (1270 mm) and 1 or more sides equal to, or greater than, 16 inches (400 mm), thickness shall be 0.138 inch (3.5 mm).

E. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.

F. Cut sleeves to length for mounting flush with both wall surfaces.

G. Extend sleeves installed in floors 2 inches (50 mm) above finished floor level.

H. Size pipe sleeves to provide 1/4-inch (6.4-mm) annular clear space between sleeve and cable unless sleeve seal is to be installed **unless seismic criteria require different clearance**.

I. Seal space outside of sleeves with grout for penetrations of concrete and masonry **and with approved joint compound for gypsum board assemblies**.

J. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and cable, using joint sealant appropriate for size, depth, and location of joint according to Division 7 Section "Joint Sealants."

K. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at cable penetrations. Install sleeves and seal with firestop materials according to Division 7 Section "Through-Penetration Firestop Systems."

L. Roof-Penetration Sleeves: Seal penetration of individual cables with flexible boot-type flashing units applied in coordination with roofing work.

M. Aboveground Exterior-Wall Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Size sleeves to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.

N. Underground Exterior-Wall Penetrations: Install cast-iron "wall pipes" for sleeves. Size sleeves to allow for 1-inch (25-mm) annular clear space between cable and sleeve for installing mechanical sleeve seals.

3.6 SLEEVE-SEAL INSTALLATION

A. Install to seal underground exterior-wall penetrations.

B. Use type and number of sealing elements recommended by manufacturer for cable material and size. Position cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.7 FIRE STOPPING

A. Apply fire stopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly according to Division 7 Section "Through-Penetration Firestop Systems."

3.8 FIELD QUALITY CONTROL

A. Perform tests and inspections and prepare test reports.

B. Tests and Inspections:

1. After installing conductors and cables and before electrical circuitry has been energized, test **all normal and emergency feeder conductors** for compliance with requirements.

2. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
3. Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each splice in cables and conductors No. 3 AWG and larger. Remove box and equipment covers so splices are accessible to portable scanner.

    a. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each splice 11 months after date of Substantial Completion.
    b. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
    c. Record of Infrared Scanning: Prepare a certified report that identifies splices checked and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

C. Test Reports: Prepare a written report to record the following:

1. Test procedures used.
2. Test results that comply with requirements.
3. Test results that do not comply with requirements and corrective action taken to achieve compliance with requirements.

D. Remove and replace malfunctioning units and retest as specified above.

END OF SECTION 16120

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 raceways, fittings, boxes, enclosures, and cabinets for electrical wiring.

B. Related Sections include the following:

1. Division 2 Section "Underground Ducts and Utility Structures" for exterior duct banks, manholes, and underground utility construction.

1.3 DEFINITIONS

A. EMT: Electrical metallic tubing.

B. ENT: Electrical nonmetallic tubing.

C. EPDM: Ethylene-propylene-diene terpolymer rubber.

D. FMC: Flexible metal conduit.

E. IMC: Intermediate metal conduit.

F. LFMC: Liquid tight flexible metal conduit.

G. LFNC: Liquid tight flexible nonmetallic conduit.

H. NBR: Acrylonitrile-butadiene rubber.

I. RNC: Rigid nonmetallic conduit.

1.4 SUBMITTALS

A. Product Data: For surface raceways, wire ways and fittings, floor boxes, hinged-cover enclosures and cabinets.

B. Shop Drawings: For the following raceway components. Include plans, elevations, sections, details, and attachments to other work.

1. Custom enclosures and cabinets.
2. For hand holes and boxes for underground wiring, including the following:

a. Duct entry provisions, including locations and duct sizes.
b. Frame and cover design.
c. Grounding details.
d. Dimensioned locations of cable rack inserts, and pulling-in and lifting irons.
e. Joint details.

C. Coordination Drawings: Conduit routing plans, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:

1. Structural members in the paths of conduit groups with common supports.
2. HVAC and plumbing items and architectural features in the paths of conduit groups with common supports.

D. Manufacturer Seismic Qualification Certification: Submit certification that enclosures and cabinets and their mounting provisions, including those for internal components, will withstand seismic forces defined in Division 16 Section "Electrical Supports and Seismic Restraints." Include the following:

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.

a. The term "withstand" means "the cabinet or enclosure will remain in place without separation of any parts when subjected to the seismic forces specified **and the unit will retain its enclosure characteristics, including its interior accessibility, after the seismic event**."

2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

E. Qualification Data: For professional engineer and testing agency.

F. Source quality-control test reports.

1.5 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 METAL CONDUIT AND TUBING

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:

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

1. AFC Cable Systems, Inc.
2. Alflex Inc.
3. Allied Tube & Conduit; a Tyco International Ltd. Co.
4. Anamet Electrical, Inc.; Anaconda Metal Hose.
5. Electri-Flex Co.
6. Manhattan/CDT/Cole-Flex.
7. Maverick Tube Corporation.
8. O-Z Gedney; a unit of General Signal.
9. Wheatland Tube Company.
10. <**Insert manufacturer's name.**>

C. Rigid Steel Conduit: ANSI C80.1.

D. IMC: ANSI C80.6.

E. EMT: ANSI C80.3.

F. FMC: [**Zinc-coated steel**][**or aluminum**].

G. LFMC: Flexible steel conduit with PVC jacket.

H. Fittings for Conduit (Including all Types and Flexible and Liquid tight), EMT, and Cable: NEMA FB 1; listed for type and size raceway with which used, and for application and environment in which installed.

1. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 886.
2. Fittings for EMT: **Steel**, **set-screw** type.
3. Coating for Fittings for PVC-Coated Conduit: Minimum thickness, 0.040 inch (1 mm), with overlapping sleeves protecting threaded joints.

I. Joint Compound for Rigid Steel Conduit or IMC: Listed for use in cable connector assemblies, and compounded for use to lubricate and protect threaded raceway joints from corrosion and enhance their conductivity.

2.2 OPTICAL FIBER/COMMUNICATIONS CABLE RACEWAY AND FITTINGS

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:

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

1. Arnco Corporation.
2. Endot Industries Inc.
3. IPEX Inc.
4. Lamson & Sessions; Carlon Electrical Products.

C. Description: Comply with UL 2024; flexible type, approved for [**plenum**] [**riser**] [**general-use**] installation.

2.3 METAL WIREWAYS

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:

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

1. Cooper B-Line, Inc.
2. Hoffman.
3. Square D; Schneider Electric.
4. Wiremold

C. Description: Sheet metal sized and shaped as indicated, NEMA 250, Type [**1**] [**12**] [**3R**], unless otherwise indicated.

D. Fittings and Accessories: Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wire ways as required for complete system.

E. Wireway Covers: **As indicated**.

F. Finish: Manufacturer's standard enamel finish.

2.4 NONMETALLIC WIREWAYS

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:

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

1. Hoffman.
2. Lamson & Sessions; Carlon Electrical Products.

C. Description: Fiberglass polyester, extruded and fabricated to size and shape indicated, with no holes or knockouts. Cover is gasketed with oil-resistant gasket material and fastened with captive screws treated for corrosion resistance. Connections are flanged, with stainless-steel screws and oil-resistant gaskets.

D. Description: PVC plastic, extruded and fabricated to size and shape indicated, with snap-on cover and mechanically coupled connections with plastic fasteners.

E. Fittings and Accessories: Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wire ways as required for complete system.

2.5 SURFACE RACEWAYS

A. Surface Metal Raceways: Galvanized steel with snap-on covers. [**Manufacturer's standard enamel finish in color selected by Architect**] [**Prime coating, ready for field painting**].

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. Thomas & Betts Corporation.
    b. Walker Systems, Inc.; Wiremold Company (The).
    c. Wiremold Company (The); Electrical Sales Division.
    d. <**Insert manufacturer's name.**>

B. Surface Nonmetallic Raceways: Two-piece construction, manufactured of rigid PVC with texture and color selected by Architect from [**manufacturer's standard**] [**custom**] colors.

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. Butler Manufacturing Company; Walker Division.
    b. Enduro Systems, Inc.; Composite Products Division.
    c. Hubbell Incorporated; Wiring Device-Kellems Division.
    d. Lamson & Sessions; Carlon Electrical Products.
    e. Panduit Corp.
    f. Walker Systems, Inc.; Wiremold Company (The).
    g. Wiremold Company (The); Electrical Sales Division.
    h. <**Insert manufacturer's name.**>

2.6 BOXES, ENCLOSURES, AND CABINETS

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:

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

1. Cooper Crouse-Hinds; Div. of Cooper Industries, Inc.
2. EGS/Appleton Electric.
3. Erickson Electrical Equipment Company.
4. Hoffman.
5. Hubbell Incorporated; Killark Electric Manufacturing Co. Division.
6. O-Z/Gedney; a unit of General Signal.
7. RACO; a Hubbell Company.
8. Robroy Industries, Inc.; Enclosure Division.
9. Scott Fetzer Co.; Adalet Division.
10. Spring City Electrical Manufacturing Company.
11. Thomas & Betts Corporation.
12. Walker Systems, Inc.; Wiremold Company (The).
13. Woodhead, Daniel Company; Woodhead Industries, Inc. Subsidiary.

C. Sheet Metal Outlet and Device Boxes: NEMA OS 1.

D. Cast-Metal Outlet and Device Boxes: NEMA FB 1, **ferrous alloy**, Type FD, with gasketed cover.

E. Nonmetallic Outlet and Device Boxes: NEMA OS 2.

F. Metal Floor Boxes: **Cast metal fully adjustable**, rectangular.

G. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.

H. Cast-Metal Access, Pull, and Junction Boxes: NEMA FB 1, [**cast aluminum**] [**galvanized, cast iron**] with gasketed cover.

I. Hinged-Cover Enclosures: NEMA 250, Type 1, with continuous-hinge cover with flush latch, unless otherwise indicated.

1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
2. Nonmetallic Enclosures: Plastic[**, finished inside with radio-frequency-resistant paint**].

J. Cabinets:

1. NEMA 250, Type 1, galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
2. Hinged door in front cover with flush latch and concealed hinge.
3. Key latch to match panelboards.
4. Metal barriers to separate wiring of different systems and voltage.
5. Accessory feet where required for freestanding equipment.

2.7 SLEEVES FOR RACEWAYS

A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.

B. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

C. Sleeves for Rectangular Openings: Galvanized sheet steel with minimum 0.052- or 0.138-inch (1.3- or 3.5-mm) thickness as indicated and of length to suit application.

D. Coordinate sleeve selection and application with selection and application of fire stopping specified in Division 7 Section "Through-Penetration Firestop Systems."

2.8 SLEEVE SEALS

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:

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

C. Basis-of-Design Product: Subject to compliance with requirements, provide [**the product indicated on Drawings**] <**Insert manufacturer's name; product name or designation**> or a comparable product by one of the following:

1. Advance Products & Systems, Inc.
2. Calpico, Inc.
3. Metraflex Co.
4. Pipeline Seal and Insulator, Inc.
5. <**Insert manufacturer's name.**>

D. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and cable.

1. Sealing Elements: **EPDM**> interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of raceway or cable.
2. Pressure Plates: **Carbon steel**. Include two for each sealing element.
3. Connecting Bolts and Nuts: [**Carbon steel with corrosion-resistant coating**] [**Stainless steel**] of length required to secure pressure plates to sealing elements. Include one for each sealing element.

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

A. Outdoors: Apply raceway products as specified below, unless otherwise indicated:

1. Exposed Conduit: **Rigid steel conduit**.
2. Concealed Conduit, Aboveground: **EMT**.
3. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): **LFMC**.
4. Boxes and Enclosures, Aboveground: NEMA 250, Type [**3R**] [**4**].
   a.

B. Comply with the following indoor applications, unless otherwise indicated:

1. Exposed, Not Subject to Physical Damage: **EMT**.
2. Exposed, Not Subject to Severe Physical Damage: **Rigid steel conduit** RMC.
3. Exposed and Subject to Severe Physical Damage: **Rigid steel conduit**. Includes raceways in the following locations:
   a. Corridors used for traffic of mechanized carts, forklifts, and pallet-handling units.
   b. Mechanical rooms.
4. Concealed in Ceilings and Interior Walls and Partitions: **EMT**
5. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.
6. Damp or Wet Locations: **Rigid steel conduit**.
7. Raceways for Optical Fiber or Communications Cable in Spaces Used for Environmental Air: **Plenum-type, optical fiber/communications cable raceway EMT raceway type**.
8. Raceways for Concealed General Purpose Distribution of Optical Fiber or Communications Cable:

9. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4, **stainless steel** in damp or wet locations.

C. Minimum Raceway Size: [**1/2-inch (16-mm)**] [**3/4-inch (21-mm)**] trade size.

3.2 INSTALLATION

A. Comply with NECA 1 for installation requirements applicable to products specified in Part 2 except where requirements on Drawings or in this Article are stricter.

B. Keep raceways at least 6 inches (150 mm) away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.

C. Complete raceway installation before starting conductor installation.

D. Support raceways as specified in Division 16 Section "Electrical Supports and Seismic Restraints."

E. Arrange stub-ups so curved portions of bends are not visible above the finished slab.

F. Install no more than the equivalent of three 90-degree bends in any conduit run except for communications conduits, for which fewer bends are allowed.

G. Conceal conduit and EMT within finished walls, ceilings, and floors, unless otherwise indicated.

H. Raceways Embedded in Slabs:

1. Run conduit larger than 1-inch (27-mm) trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support.
2. Arrange raceways to cross building expansion joints at right angles with expansion fittings.
3. Change from ENT to RNC, Type EPC-40-PVC, rigid steel conduit, or IMC before rising above the floor.

I. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.

J. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors, including conductors smaller than No. 4 AWG.

K. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb (90-kg) tensile strength. Leave at least 12 inches (300 mm) of slack at each end of pull wire.

L. Raceways for Optical Fiber and Communications Cable: Install raceways, metallic and nonmetallic, rigid and flexible, as follows:

1. 3/4-Inch (19-mm) Trade Size and Smaller: Install raceways in maximum lengths of 50 feet (15 m).
2. 1-Inch (25-mm) Trade Size and Larger: Install raceways in maximum lengths of 75 feet (23 m).

3. Install with a maximum of two 90-degree bends or equivalent for each length of raceway unless Drawings show stricter requirements. Separate lengths with pull or junction boxes or terminations at distribution frames or cabinets where necessary to comply with these requirements.

M. Install raceway sealing fittings at suitable, approved, and accessible locations and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings at the following points:

1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
2. Where otherwise required by NFPA 70.

N. Expansion-Joint Fittings for RNC: Install in each run of aboveground conduit that is located where environmental temperature change may exceed 30 deg F (17 deg C), and that has straight-run length that exceeds 25 feet (7.6 m).

1. Install expansion-joint fittings for each of the following locations, and provide type and quantity of fittings that accommodate temperature change listed for location:
   a. Indoor Spaces: Connected with the Outdoors without Physical Separation: [**125 deg F (70 deg C)**] temperature change.
   b. Attics: **135 deg F (75 deg C)** temperature change.

2. Install fitting(s) that provide expansion and contraction for at least 0.00041 inch per foot of length of straight run per deg F (0.06 mm per meter of length of straight run per deg C) of temperature change.
3. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at the time of installation.

O. Flexible Conduit Connections: Use maximum of 72 inches (1830 mm) of flexible conduit for **recessed lighting fixtures,** equipment subject to vibration, noise transmission, or movement; and for transformers and motors.

1. Use LFMC in damp or wet locations subject to severe physical damage.
2. Use LFMC or LFNC in damp or wet locations not subject to severe physical damage.

P. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall.

Q. Set metal floor boxes level and flush with finished floor surface.

R. Set nonmetallic floor boxes level. Trim after installation to fit flush with finished floor surface.

3.3 ``SLEEVE INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 7 Section "Through-Penetration Firestop Systems."

B. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.

C. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.

D. Rectangular Sleeve Minimum Metal Thickness:

1. For sleeve cross-section rectangle perimeter less than 50 inches (1270 mm) and no side greater than 16 inches (400 mm), thickness shall be 0.052 inch (1.3 mm).
2. For sleeve cross-section rectangle perimeter equal to, or greater than, 50 inches (1270 mm) and 1 or more sides equal to, or greater than, 16 inches (400 mm), thickness shall be 0.138 inch (3.5 mm).

E. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.

F. Cut sleeves to length for mounting flush with both surfaces of walls.

G. Extend sleeves installed in floors 2 inches (50 mm) above finished floor level.

H. Size pipe sleeves to provide 1/4-inch (6.4-mm) annular clear space between sleeve and raceway unless sleeve seal is to be installed[**or unless seismic criteria require different clearance**].

I. Seal space outside of sleeves with grout for penetrations of concrete and masonry[**and with approved joint compound for gypsum board assemblies**].

J. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and raceway, using joint sealant appropriate for size, depth, and location of joint. Refer to Division 7 Section "Joint Sealants" for materials and installation.

K. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at raceway penetrations. Install sleeves and seal with firestop materials. Comply with Division 7 Section "Through-Penetration Firestop Systems."

L. Roof-Penetration Sleeves: Seal penetration of individual raceways with flexible, boot-type flashing units applied in coordination with roofing work.

M. Aboveground, Exterior-Wall Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.

N. Underground, Exterior-Wall Penetrations: Install cast-iron "wall pipes" for sleeves. Size sleeves to allow for 1-inch (25-mm) annular clear space between raceway and sleeve for installing mechanical sleeve seals.

3.4 SLEEVE-SEAL INSTALLATION

A. Install to seal underground, exterior wall penetrations.

B. Use type and number of sealing elements recommended by manufacturer for raceway material and size. Position raceway in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.5 FIRE STOPPING

A. Apply fire stopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly. Fire stopping materials and installation requirements are specified in Division 7 Section "Through-Penetration Firestop Systems."

3.6 PROTECTION

A. Provide final protection and maintain conditions that ensure coatings, finishes, and cabinets are without damage or deterioration at time of Substantial Completion.

1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
2. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION 16130

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. Receptacles, receptacles with integral GFCI, and associated device plates.
2. Twist-locking receptacles.
3. Receptacles with integral surge suppression units.
4. Wall-box motion sensors.
5. Isolated-ground receptacles.
6. Snap switches and wall-box dimmers.
7. Solid-state fan speed controls.
8. Wall-switch and exterior occupancy sensors.
9. Communications outlets.
10. Pendant cord-connector devices.
11. Cord and plug sets.
12. Floor service outlets, poke-through assemblies, service poles, and multioutlet assemblies.

B. Related Sections include the following:

1. Division 16 Section "Voice and Data Communication Cabling" for workstation outlets.

1.3 DEFINITIONS

A. EMI: Electromagnetic interference.

B. GFCI: Ground-fault circuit interrupter.

C. Pigtail: Short lead used to connect a device to a branch-circuit conductor.

D. RFI: Radio-frequency interference.

E. TVSS: Transient voltage surge suppressor.

F. UTP: Unshielded twisted pair.

1.4 SUBMITTALS

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

B. Shop Drawings: List of legends and description of materials and process used for premarking wall plates.

C. Samples: One for each type of device and wall plate specified, in each color specified.

D. Field quality-control test reports.

E. Operation and Maintenance Data: For wiring devices to include in all manufacturers' packing label warnings and instruction manuals that include labeling conditions.

1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain each type of wiring device and associated wall plate through one source from a single manufacturer. Insofar as they are available, obtain all wiring devices and associated wall plates from a single manufacturer and one source.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Comply with NFPA 70.

1.6 COORDINATION

A. Receptacles for Owner-Furnished Equipment: Match plug configurations.

1. Cord and Plug Sets: Match equipment requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers' Names: Shortened versions (shown in parentheses) of the following manufacturers' names are used in other Part 2 articles:

1. Cooper Wiring Devices; a division of Cooper Industries, Inc. (Cooper).
2. Hubbell Incorporated; Wiring Device-Kellems (Hubbell).
3. Leviton Mfg. Company Inc. (Leviton).
4. Pass & Seymour/Legrand; Wiring Devices & Accessories (Pass & Seymour).
5. General Electric

2.2 STRAIGHT BLADE RECEPTACLES

A. Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration 5-20R, and UL 498.

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

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

    a. Cooper; 5351 (single), 5352 (duplex).
    b. Hubbell; HBL5351 (single), CR5352 (duplex).
    c. Leviton; 5891 (single), 5352 (duplex).
    d. Pass & Seymour; 5381 (single), 5352 (duplex).
    e. General Electric

B. Hospital-Grade, Duplex Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration 5-20R, and UL 498 Supplement SD.

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
2. Products: Subject to compliance with requirements, provide one of the following:

    a. Cooper; 8300 (duplex).
    b. Hubbell; HBL8310 (single), HBL8300H (duplex).
    c. Leviton; 8310 (single), 8300 (duplex).
    d. Pass & Seymour; 9301-HG (single), 9300-HG (duplex).

C. Isolated-Ground, Duplex Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration 5-20R, and UL 498.

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
2. Products: Subject to compliance with requirements, provide one of the following:

    a. Hubbell; CR 5253IG.
    b. Leviton; 5362-IG.
    c. Pass & Seymour; IG6300.

3. General Electric Description: Straight blade; equipment grounding contacts shall be connected only to the green grounding screw terminal of the device and with inherent electrical isolation from mounting strap. Isolation shall be integral to receptacle construction and not dependent on removable parts.

D. Tamper-Resistant Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration 5-20R, and UL 498.

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
2. Products: Subject to compliance with requirements, provide one of the following:

    a. Cooper; TR8300.
    b. Hubbell; HBL8300SG.
    c. Leviton; 8300-SGG.
    d. Pass & Seymour; 63H.

3. General Electric Description: Labeled to comply with NFPA 70, "Health Care Facilities" Article, "Pediatric Locations" Section.

2.3 GFCI RECEPTACLES

A. General Description: Straight blade, [**feed**] [**non-feed**]-through type. Comply with NEMA WD 1, NEMA WD 6, UL 498, and UL 943, Class A, and include indicator light that is lighted when device is tripped.

B. Duplex GFCI Convenience Receptacles, 125 V, 20 A:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
2. Products: Subject to compliance with requirements, provide one of the following:

a. Cooper; GF20.
b. Pass & Seymour; 2084.
c. Leviton

C. Hospital-Grade, Duplex GFCI Convenience Receptacles, 125 V, 20 A: Comply with UL 498 Supplement SD.

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
2. Products: Subject to compliance with requirements, provide one of the following:

a. Cooper; HGF20.
b. Hubbell; HGF8300.
c. Leviton; 6898-HG.
d. Pass & Seymour; 2091-SHG.

D. Hospital-Grade, Duplex Convenience Receptacles: Comply with UL 498 Supplement SD.

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
2. Products: Subject to compliance with requirements, provide one of the following:

a. Cooper; 8300BLS.
b. Hubbell; HBL8362SA.
c. Leviton; 8380.
d. <**Insert manufacturer's name; catalog number.**>

3. Description: Straight blade, 125 V, 20 A; NEMA WD 6 configuration 5-20R.

2.4 TWIST-LOCKING RECEPTACLES

A. Single Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration L5-20R, and UL 498.

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
2. Products: Subject to compliance with requirements, provide one of the following:

a. Cooper; L520R.
b. Hubbell; HBL2310.

c. Leviton; 2310.
d. Pass & Seymour; L520-R.

B. Isolated-Ground, Single Convenience Receptacles, 125 V, 20 A:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
2. Products: Subject to compliance with requirements, provide one of the following:

a. Hubbell; IG2310.
b. Leviton; 2310-IG.

3. Description: Comply with NEMA WD 1, NEMA WD 6 configuration L5-20R, and UL 498. Equipment grounding contacts shall be connected only to the green grounding screw terminal of the device and with inherent electrical isolation from mounting strap. Isolation shall be integral to receptacle construction and not dependent on removable parts.

2.5 SNAP SWITCHES

A. Comply with NEMA WD 1 and UL 20.

B. Switches, 120/277 V, 20 A:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
2. Products: Subject to compliance with requirements, provide one of the following:

a. Cooper; 2221 (single pole), 2222 (two pole), 2223 (three way), 2224 (four way).
b. Hubbell; CS1221 (single pole), CS1222 (two pole), CS1223 (three way), CS1224 (four way).
c. Leviton; 1221-2 (single pole), 1222-2 (two pole), 1223-2 (three way), 1224-2 (four way).
d. Pass & Seymour; 20AC1 (single pole), 20AC2 (two pole), 20AC3 (three way), 20AC4 (four way).
e. <**Insert manufacturer's name; catalog numbers.**>

C. Pilot Light Switches, 20 A:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
2. Products: Subject to compliance with requirements, provide one of the following:

a. Cooper; 2221PL for 120 V and 277 V.
b. Hubbell; HPL1221PL for 120 V and 277 V.
c. Leviton; 1221-PLR for 120 V, 1221-7PLR for 277 V.
d. Pass & Seymour; PS20AC1-PLR for 120 V.
e. <**Insert manufacturer's name; catalog numbers.**>

3. Description: Single pole, with neon-lighted handle, illuminated when switch is "ON."

D. Single-Pole, Double-Throw, Momentary Contact, Center-Off Switches, 120/277 V, 20 A; for use with mechanically held lighting contactors.

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
2. Products: Subject to compliance with requirements, provide one of the following:

    a. Cooper; 1995.
    b. Hubbell; HBL1557.
    c. Leviton; 1257.
    d. Pass & Seymour; 1251.

E. Key-Operated, Single-Pole, Double-Throw, Momentary Contact, Center-Off Switches, 120/277 V, 20 A; for use with mechanically held lighting contactors, with factory-supplied key in lieu of switch handle.

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
2. Products: Subject to compliance with requirements, provide one of the following:

    a. Cooper; 1995L.
    b. Hubbell; HBL1557L.
    c. Leviton; 1257L.
    d. Pass & Seymour; 1251L.
    e. <**Insert manufacturer's name; catalog number.**>

2.6 WALL-BOX DIMMERS

A. Dimmer Switches: Modular, full-wave, solid-state units with integral, quiet on-off switches, with audible frequency and EMI/RFI suppression filters suitable for LED lighting.

B. Control: Continuously adjustable **slider**; with single-pole or three-way switching. Comply with UL 1472.

1. 600 W; dimmers shall require no derating when ganged with other devices. [**Illuminated when "OFF."**]

2.7 FAN SPEED CONTROLS

A. Modular, 120-V, full-wave, solid-state units with integral, quiet on-off switches and audible frequency and EMI/RFI filters. Comply with UL 1917.

1. Continuously adjustable **slider5 A**.

2.8 OCCUPANCY SENSORS

A. Wall-Switch Sensors:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
2. Products: Subject to compliance with requirements, provide one of the following:

    a. Cooper; 6111 for 120 V, 6117 for 277 V.

b. Hubbell; WS1277.
c. Leviton; ODS 10-ID.
d. Pass & Seymour; WS3000.
e. Watt Stopper (The); WS-200.

3. Description: Passive-infrared type, 120/277 V, adjustable time delay up to 30 minutes, 180-degree field of view, with a minimum coverage area of 900 sq. ft. (84 sq. m).

B. Wall-Switch Sensors:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
2. Products: Subject to compliance with requirements, provide one of the following:

a. Hubbell; AT120 for 120 V, AT277 for 277 V.
b. Leviton; ODS 15-ID.
c. General Electric

3. Description: Adaptive-technology type, 120/277 V, adjustable time delay up to 20 minutes, 180-degree field of view, with a minimum coverage area of 900 sq. ft. (84 sq. m).

C. Long-Range Wall-Switch Sensors:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
2. Products: Subject to compliance with requirements, provide one of the following:

a. Hubbell; ATP1600WRP.
b. Leviton; ODWWV-IRW.
c. Pass & Seymour; WA1001.
d. Watt Stopper (The); CX-100.

3. Description: Passive-infrared type, 120/277 V, adjustable time delay up to 30 minutes, 110-degree field of view, with a minimum coverage area of 1200 sq. ft. (111 sq. m).

D. Long-Range Wall-Switch Sensors:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
2. Products: Subject to compliance with requirements, provide one of the following:

a. Hubbell; ATD1600WRP.
b. Leviton; ODW12-MRW.
c. Watt Stopper (The); DT-200.

3. Description: Dual technology, with both passive-infrared- and ultrasonic-type sensing, 120/277 V, adjustable time delay up to 30 minutes, 110-degree field of view, and a minimum coverage area of 1200 sq. ft. (111 sq. m).

E. Wide-Range Wall-Switch Sensors:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
2. Products: Subject to compliance with requirements, provide one of the following:

    a. Hubbell; ATP120HBRP.
    b. Leviton; ODWHB-IRW.
    c. Pass & Seymour; HS1001.
    d. Watt Stopper (The); CX-100-3.

3. Description: Passive-infrared type, 120/277 V, adjustable time delay up to 30 minutes, 150-degree field of view, with a minimum coverage area of 1200 sq. ft. (111 sq. m).

2.9 COMMUNICATIONS OUTLETS

A. Telephone Outlet:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
2. Products: Subject to compliance with requirements, provide one of the following:

    a. Cooper; 3560-6.
    b. Leviton; 40649.
    c. Specific to the owners requirement

3. Description: Single RJ-45 jack for terminating 100-ohm, balanced, four-pair UTP; TIA/EIA-568-B.1; complying with Category 5e. Comply with UL 1863.

B. Combination TV and Telephone Outlet:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
2. Products: Subject to compliance with requirements, provide one of the following:

    a. Cooper; 3562.
    b. Leviton; 40595.

3. Specific to the owners requirement Description: Single RJ-45 jack for 100-ohm, balanced, four-pair UTP; TIA/EIA-568-B.1; complying with Category 5e; and one Type F coaxial cable connector.

2.10 WALL PLATES

A. Single and combination types to match corresponding wiring devices.

1. Plate-Securing Screws: Metal with head color to match plate finish.
2. Material for Finished Spaces: **satin-finished stainless steel 0.04-inch- (1-mm-) thick**.
3. Material for Unfinished Spaces: **Galvanized steel** Material for Damp Locations: **Cast aluminum** with spring-loaded lift cover, and listed and labeled for use in "wet locations."

2.11 FINISHES

A. Color: Wiring device catalog numbers in Section Text do not designate device color.

1. Wiring Devices Connected to Normal Power System: **Almond** , unless otherwise indicated or required by NFPA 70 or device listing.
2. Wiring Devices Connected to Emergency Power System: **Red** .
3. TVSS Devices: Blue.
4. Isolated-Ground Receptacles: **Orange**.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with NECA 1, including the mounting heights listed in that standard, unless otherwise noted.

B. Coordination with Other Trades:

1. Take steps to insure that devices and their boxes are protected. Do not place wall finish materials over device boxes and do not cut holes for boxes with routers that are guided by riding against outside of the boxes.
2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
4. Install wiring devices after all wall preparation, including painting, is complete.

C. Conductors:

1. Do not strip insulation from conductors until just before they are spliced or terminated on devices.
2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
3. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtails.
4. Existing Conductors:

a. Cut back and pigtail, or replace all damaged conductors.
b. Straighten conductors that remain and remove corrosion and foreign matter.
c. Pig tailing existing conductors is permitted provided the outlet box is large enough.

D. Device Installation:

1. Replace all devices that have been in temporary use during construction or that show signs that they were installed before building finishing operations were complete.
2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.

4. Connect devices to branch circuits using pigtails that are not less than 6 inches (152 mm) in length.
5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, 2/3 to 3/4 of the way around terminal screw.
6. Use a torque screwdriver when a torque is recommended or required by the manufacturer.
7. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.
8. Tighten unused terminal screws on the device.
9. When mounting into metal boxes, remove the fiber or plastic washers used to hold device mounting screws in yokes, allowing metal-to-metal contact.

E. Receptacle Orientation:

1. Install ground pin of vertically mounted receptacles **up**, and on horizontally mounted receptacles to the **left**.
2. Install hospital-grade receptacles in patient-care areas with the ground pin or neutral blade at the top.

F. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.

G. Dimmers:

1. Install dimmers within terms of their listing.
2. Verify that dimmers used for fan speed control are listed for that application.
3. Install unshared neutral conductors on line and load side of dimmers according to manufacturers' device listing conditions in the written instructions.

H. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on top. Group adjacent switches under single, multi gang wall plates.

I. Adjust locations of floor service outlets and service poles to suit arrangement of partitions and furnishings.

3.2 IDENTIFICATION

A. Comply with Division 16 Section "Electrical Identification."

1. Receptacles: Identify panelboard and circuit number from which served. Use hot, stamped or engraved machine printing with **white** filled lettering on face of plate, and durable wire markers or tags inside outlet boxes.

3.3 FIELD QUALITY CONTROL

A. Perform tests and inspections and prepare test reports.

1. In healthcare facilities, prepare reports that comply with recommendations in NFPA 99.
2. Test Instruments: Use instruments that comply with UL 1436.

3. Test Instrument for Convenience Receptacles: Digital wiring analyzer with digital readout or illuminated LED indicators of measurement.

B. Tests for Convenience Receptacles:

1. Line Voltage: Acceptable range is 105 to 132 V.
2. Percent Voltage Drop under 15-A Load: A value of 6 percent or higher is not acceptable.
3. Ground Impedance: Values of up to 2 ohms are acceptable.
4. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.
5. Using the test plug, verify that the device and its outlet box are securely mounted.
6. The tests shall be diagnostic, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault current path, defective devices, or similar problems. Correct circuit conditions, remove malfunctioning units and replace with new ones, and retest as specified above.

C. Test straight blade [**convenience outlets in patient-care areas**] [**hospital-grade convenience outlets**] for the retention force of the grounding blade according to NFPA 99. Retention force shall be not less than 4 oz. (115 g).

END OF SECTION 16140

PART 1. GENERAL

1.01. RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.02. SUMMARY

A. This Section includes the following individually mounted, enclosed switches and circuit breakers:

1. Fusible switches.
2. Non fusible switches.
3. Molded-case circuit breakers.
4. Enclosures.

1.03. DEFINITIONS

A. GD: General duty.

B. GFCI: Ground-fault circuit interrupter.

C. HD: Heavy duty.

D. RMS: Root mean square.

E. SPDT: Single pole, double throw.

1.04. REFERENCES

A. NFPA 70: National Electrical Code.

B. NEMA ks1: Enclosed switches.

1.05. SUBMITTALS

A. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated. Include dimensioned elevations, sections, weights, and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.

1. Enclosure types and details for types other than NEMA 250, Type 1.

2. Current and voltage ratings.

3. Short-circuit current rating.

4. Features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.

B. Shop Drawings: Diagram power, signal, and control wiring.

C. Operation and Maintenance Data: For enclosed switches and circuit breakers to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 1 Section "Operation and Maintenance Data," include the following:

1. Manufacturer's written instructions for testing and adjusting enclosed switches and circuit breakers.

2. Time-current curves, including selectable ranges for each type of circuit breaker.

1.06. QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1.07. PROJECT CONDITIONS

A. Environmental Limitations: Rate equipment for continuous operation under the following conditions, unless otherwise indicated:

1. Ambient Temperature: Not less than minus 22 deg F (minus 30 deg C) and not exceeding 104 deg F (40 deg C).

2. Altitude: Not exceeding 6600 feet (2010 m).

1.08. COORDINATION

A. Coordinate layout and installation of switches, circuit breakers, and components with other construction, including conduit, piping, equipment, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

1.09. EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Spares: For the following:

a. Fuses for Fusible Switches: One set for each switch supplied.

PART 2. PRODUCTS

2.01. MANUFACTURERS

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

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

2.02. FUSIBLE AND NONFUSIBLE SWITCHES

A. Manufacturers:

1. Square D/Group Schneider.

2. General Electric Co.; Electrical Distribution & Control Division.

3. Eaton Corporation; Cutler-Hammer Products.

B. Fusible Switch, 600 A and Smaller: Type HD, with clips or bolt pads to accommodate specified fuses, lockable handle with capability to accept two padlocks, and interlocked with cover in closed position.

C. Non fusible Switch, 600 A and Smaller: Type HD, lockable handle with capability to accept two padlocks, and interlocked with cover in closed position.

D. Accessories:

1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.

2. Neutral Kit: Internally mounted; insulated, capable of being grounded, and bonded; and labeled for copper and aluminum neutral conductors.

3. Auxiliary Contact Kit: Auxiliary set of contacts arranged to open before switch blades open.

2.03. MOLDED-CASE CIRCUIT BREAKERS AND SWITCHES

A. Manufacturers:

1. Square D/Group Schneider.

2. General Electric Co.; Electrical Distribution & Control Division.

3. Eaton Corporation; Cutler-Hammer Products.

B. Molded-Case Circuit Breaker: NEMA AB 1, with interrupting capacity to meet available fault currents.

1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.

2. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.

3. Electronic Trip-Unit Circuit Breakers: RMS sensing; field-replaceable rating plug; with the following field-adjustable settings:

   a. Instantaneous trip.

   b. Long- and short-time pickup levels.

   c. Long- and short-time time adjustments.

   d. Ground-fault pickup level, time delay, and I^2t response.

C. Molded-Case Circuit-Breaker Features and Accessories:

1. Standard frame sizes, trip ratings, and number of poles.

2. Lugs: Mechanical style suitable for number, size, trip ratings, and conductor material.

3. Application Listing: Type SWD for switching fluorescent lighting loads; Type HACR for heating, air-conditioning, and refrigerating equipment.

4. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator where indicated.

5. Shunt Trip: 120-V trip coil energized from separate circuit, set to trip at indicated percent of rated voltage.

2.04. ENCLOSURES

A. NEMA AB 1 and NEMA KS 1 to meet environmental conditions of installed location.

1. Outdoor Locations: NEMA 250, Type 3R.

2. Other Wet or Damp Indoor Locations: NEMA 250, Type 4.

3. Finishes: Manufacturers standard prime coat finish.. ANSI 61 grey.

PART 3. EXECUTION

3.01. EXAMINATION

A. Examine elements and surfaces to receive enclosed switches and circuit breakers for compliance with installation tolerances and other conditions affecting performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02. INSTALLATION

A. Mount individual wall-mounting switches and circuit breakers with tops at uniform height, unless otherwise indicated. Anchor floor-mounting switches to concrete base.

3.03. IDENTIFICATION

A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs as specified in Division 16 Section "Electrical Identification."

B. Enclosure Nameplates: Label each enclosure as specified in Division 16 Section "Electrical Identification."

3.04. FIELD QUALITY CONTROL

A. Prepare for acceptance testing as follows:

1. Inspect mechanical and electrical connections.

2. Verify switch and labeling verification.

3. Verify rating of installed fuses.

4. Inspect proper installation of type, size, quantity, and arrangement of mounting or anchorage devices complying with manufacturer's certification.

B. Perform the following field tests and inspections and prepare test reports:

1. Perform each electrical test and visual and mechanical inspection. Certify compliance with test parameters.

2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

3. Infrared Scanning:

3.05. ADJUSTING

A. Set field-adjustable switches and circuit-breaker trip ranges.

3.06. CLEANING

A. On completion of installation, vacuum dirt and debris from interiors, remove paint splatter and other spots, do not use compressed air to assist in cleaning.

B. Inspect exposed surfaces and repair damaged finishes.

END SECTION 16410

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. Distribution panelboards.
2. Lighting and appliance branch-circuit panelboards.
3. Load centers.

1.3 DEFINITIONS

A. EMI: Electromagnetic interference.

B. GFCI: Ground-fault circuit interrupter.

C. RFI: Radio-frequency interference.

D. RMS: Root mean square.

E. SPDT: Single pole, double throw.

1.4 PANELBOARD MARKING.

A. Panelboards shall be durably marked and labeled by the manufacturer with the AC and DC current, voltage, short circuit ratings, and the number of phases, for which it is designed. The manufacturer’s name trade mark and applicable listings shall be included on the label and the label shall be placed in such a manner so as to clearly visible after installation.

B. The preceding information shall be clearly indicated in the submittals for the installed product

1.5 SUBMITTALS

A. Product Data: For each type of panelboard, overcurrent protective device, transient voltage suppression device, accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.

B. Shop Drawings: For each panelboard and related equipment.

1. Dimensioned plans, elevations, sections, and details. Show tabulations of installed devices, equipment features, and ratings. Include the following:

a. Enclosure types and details for types other than NEMA 250, Type 1.
b. Bus configuration, current, and voltage ratings.
c. Short-circuit current rating of panelboards and overcurrent protective devices.
d. UL listing for series rating of installed devices.
e. Features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.

2. Wiring Diagrams: Power, signal, and control wiring.

C. Manufacturer Seismic Qualification Certification: Submit certification that panelboards, overcurrent protective devices, accessories, and components will withstand seismic forces defined in Division 16 Section "Electrical Supports and Seismic Restraints." Include the following:

1. Basis of Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.

a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."
b. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

D. Qualification Data: For testing agency.

E. Field quality-control test reports including the following:

1. Test procedures used.
2. Test results that comply with requirements.
3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

F. Panelboard Schedules: For installation in panelboards. **Submit final versions after load balancing.**

G. Operation and Maintenance Data: For panelboards and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 1 Section " **Closeout Procedures Operation and Maintenance Data**," include the following:

1. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
2. Time-current curves, including selectable ranges for each type of overcurrent protective device.

1.6 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a member company of the International Electrical Testing Association or is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.

1. Testing Agency's Field Supervisor: Person currently certified by the International Electrical Testing Association or the National Institute for Certification in Engineering Technologies to supervise on-site testing specified in Part 3.

B. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7.

C. Source Limitations: Obtain panelboards, overcurrent protective devices, components, and accessories through one source from a single manufacturer.

D. Product Options: Drawings indicate size, profiles, and dimensional requirements of panelboards and are based on the specific system indicated. Refer to Division 1 Section "Product Requirements."

E. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

F. Comply with NEMA PB 1.

G. Comply with NFPA 70.

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Rate equipment for continuous operation under the following conditions, unless otherwise indicated:

1. Ambient Temperature: Not exceeding 104 deg F (40 deg C).
2. Altitude: Not exceeding 6600 feet (2000 m).

B. Service Conditions: NEMA PB 1, usual service conditions, as follows:

1. Ambient temperatures within limits specified.
2. Altitude not exceeding 6600 feet (2000 m).

C. Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:

1. Notify **Architect**, **Construction Manager**, **Owner** no fewer than [**7** days in advance of proposed interruption of electrical service.
2. Do not proceed with interruption of electrical service without **Owner's** written permission.

1.8 COORDINATION

A. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, and encumbrances to workspace clearance requirements.

B. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 3.

1.9 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Keys: (6) **Six** spares for each type of panelboard cabinet lock with keys.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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:

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

1. Panelboards, Overcurrent Protective Devices, Controllers, Contactors, and Accessories:
   a. Square D.
   b. General Electric Co.; Electrical Distribution & Protection Div
   c. Eaton Corporation;
   d. Cutler-Hammer Products.
   e. .
   f. Siemens Energy & Automation, Inc.

2.2 MANUFACTURED UNITS

A. Fabricate and test panelboards according to IEEE 344 to withstand seismic forces defined in Division 16 Section "Electrical Supports and Seismic Restraints."

B. Enclosures: **Surface** -mounted cabinets. NEMA PB 1, Type 1.

1. Rated for environmental conditions at installed location.

2. Front: Secured to box with concealed trim clamps. For surface-mounted fronts, match box dimensions; for flush-mounted fronts, overlap box.
3. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover.
4. Skirt for Surface-Mounted Panelboards: Same gage and finish as panelboard front with flanges for attachment to panelboard, wall, and ceiling or floor.
5. Finish: Manufacturer's standard enamel finish over corrosion-resistant treatment or primer coat.
6. Directory Card: With transparent protective cover, mounted in metal frame, inside panelboard door.

C. Phase and Ground Buses:

1. Material: **Hard-drawn copper, 98 percent conductivity**.
2. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment ground conductors; bonded to box.
3. Isolated Equipment Ground Bus: Adequate for branch-circuit equipment ground conductors; insulated from box.
4. Extra-Capacity Neutral Bus: Neutral bus rated 200 percent of phase bus and UL listed as suitable for nonlinear loads.

D. Conductor Connectors: Suitable for use with conductor material.

1. Main and Neutral Lugs: **Mechanical** type.
2. Ground Lugs and Bus Configured Terminators: Compression type.
3. Extra-Capacity Neutral Lugs: Rated 200 percent of phase lugs mounted on extra-capacity neutral bus.

E. Service Equipment Label: UL labeled for use as service equipment for panelboards with main service disconnect switches.

F. Future Devices: Mounting brackets, bus connections, and necessary appurtenances required for future installation of devices.

2.3 PANELBOARD SHORT-CIRCUIT RATING

A. UL label indicating series-connected rating with integral or remote upstream overcurrent protective devices. Include size and type of upstream device allowable, branch devices allowable, and UL series-connected short-circuit rating.

B. Fully rated to interrupt symmetrical short-circuit current available at terminals as indicate on the drawings.

2.4 DISTRIBUTION PANELBOARDS

A. Doors: Secured with vault-type latch with tumbler lock; keyed alike. Omit for fused-switch panelboards.

B. Main Overcurrent Protective Devices: **Circuit breaker**

C. Branch Overcurrent Protective Devices:

1. For Circuit-Breaker Frame Sizes 125 A and Smaller: **Bolt-on** circuit breakers.
2. For Circuit-Breaker Frame Sizes Larger Than 125 A: Bolt-on circuit breakers; removal.
3. Fused switches.

2.5 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

A. Branch Overcurrent Protective Devices: **Bolt-on** circuit breakers, replaceable without disturbing adjacent units.

B. Plug on circuit breakers in branch circuit or distribution panelboards will not be acceptable

C. Doors: Concealed hinges; secured with flush latch with tumbler lock; keyed alike.

2.6 LOAD CENTERS

A. Overcurrent Protective Devices: Bolt on, full-module circuit breaker.

B. Conductor Connectors: Mechanical type for main, neutral, and ground lugs and buses.

2.7 OVERCURRENT PROTECTIVE DEVICES

A. Molded-Case Circuit Breaker: UL 489, with **series-connected rating** to meet available fault currents or the values stated on the panelboard schedule.

1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads, and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.

2. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
3. Electronic trip-unit circuit breakers shall have RMS sensing; field-replaceable rating plug; and with the following field-adjustable settings:

    a. Instantaneous trip.
    b. Long- and short-time pickup levels.
    c. Long- and short-time time adjustments.
    d. Ground-fault pickup level, time delay, and I^2t response.
4. GFCI Circuit Breakers: Single- and two-pole configurations with **5**-mA trip sensitivity.

B. Molded-Case Circuit-Breaker Features and Accessories: Standard frame sizes, trip ratings, and number of poles.

1. Lugs: **Mechanical** style, suitable for number, size, trip ratings, and conductor materials.
2. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HACR for heating, air-conditioning, and refrigerating equipment.
3. Ground-Fault Protection: **Integrally mounted** relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
4. Shunt Trip: 120-V trip coil energized from separate circuit, set to trip at [**55**] [**75**] percent of rated voltage.

2.8 ACCESSORY COMPONENTS AND FEATURES

A. Furnish accessory set including tools and miscellaneous items required for overcurrent protective device test, inspection, maintenance, and operation.

B. Furnish portable test set to test functions of solid-state trip devices without removal from panelboard.

C. Fungus Proofing: Permanent fungicidal treatment for panelboard interior, including overcurrent protective devices and other components.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install panelboards and accessories according to NEMA PB 1.1.

B. Comply with mounting and anchoring requirements specified in Division 16 Section "Electrical Supports and Seismic Restraints."

C. Mount top of trim 74 inches (1880 mm) above finished floor, unless otherwise indicated.

D. Mount plumb and rigid without distortion of box. Mount recessed panelboards with fronts uniformly flush with wall finish.

E. Install overcurrent protective devices and controllers.

1. Set field-adjustable switches and circuit-breaker trip ranges.

F. Install filler plates in unused spaces.

G. Stub four 1-inch (27-GRC) empty conduits from panelboard into accessible ceiling space or space designated to be ceiling space in the future. Stub four 1-inch (27-GRC) empty conduits into raised floor space or below slab not on grade.

H. Arrange conductors in gutters into groups and bundle and wrap with wire ties **after completing load balancing**.

3.2 IDENTIFICATION

A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs as specified in Division 16 Section "Electrical Identification."

B. Create a directory to indicate installed circuit loads **after balancing panelboard loads**. Obtain approval before installing. Use a computer or typewriter to create directory; handwritten directories are not acceptable.

C. Panelboard Nameplates: Label each panelboard with engraved metal or laminated-plastic nameplate mounted with corrosion-resistant screws.

3.3 CONNECTIONS

A. Ground equipment according to Division 16 Section "Grounding and Bonding."

B. Connect wiring according to Division 16 Section "Conductors and Cables."

3.4 FIELD QUALITY CONTROL

A. Prepare for acceptance tests as follows:

1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
2. Test continuity of each circuit.

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

C. Testing Agency: Engage a qualified testing and inspecting agency to perform the following field tests and inspections and prepare test reports:

D. Perform the following field tests and inspections and prepare test reports:

1. Perform each electrical test and visual and mechanical inspection stated in NETA ATS, Section 7.5 for switches and Section 7.6 for molded-case circuit breakers. Certify compliance with test parameters.
2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

E. Load Balancing: After Substantial Completion, but not more than 60 days after Final Acceptance, measure load balancing and make circuit changes.

1. Measure as directed during period of normal system loading.
2. Perform load-balancing circuit changes outside normal occupancy/working schedule of the facility and at time directed. Avoid disrupting critical 24-hour services such as fax machines and on-line data processing, computing, transmitting, and receiving equipment.
3. After circuit changes, recheck loads during normal load period. Record all load readings before and after changes and submit test records.
4. Tolerance: Difference exceeding 20 percent between phase loads, within a panelboard, is not acceptable. Rebalance and recheck as necessary to meet this minimum requirement.

F. Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scanning of each panelboard. Remove panel fronts so joints and connections are accessible to portable scanner.

1. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each panelboard 11 months after date of Substantial Completion.
2. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
3. Record of Infrared Scanning: Prepare a certified report that identifies panelboards checked and describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.5 CLEANING

A. On completion of installation, inspect interior and exterior of panelboards. Remove paint splatters and other spots. Vacuum dirt and debris; do not use compressed air to assist in cleaning. Repair exposed surfaces to match original finish.

END OF SECTION 16442

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PART 2 - GENERAL

2.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

2.2 SUMMARY

A. This Section includes the following:

1. Interior LED lighting fixtures.
2. Emergency LED lighting fixtures.
3. LED Exit signs.
4. Lighting fixture supports.
5. Retrofit kits for fluorescent lighting fixtures.

B. Related Sections include the following:
1. Division 16 Section "Wiring Devices" for manual wall-box dimmers for incandescent lamps.
2. Division 16 Section "Lighting Control Devices" for automatic control of lighting, including time switches, photoelectric relays, occupancy sensors, and multipole lighting relays and contactors.
3. Division 16 Section "Dimming Controls" for architectural dimming systems.

2.3 DEFINITIONS

A. BF: Ballast factor.

B. CRI: Color-rendering index.

C. CU: Coefficient of utilization.

D. LEDLight Emitting DiodeLER: Luminaire efficacy rating.

E. Luminaire: Complete lighting fixture, including ballast housing if provided.

F. RCR: Room cavity ratio.

2.4 SUBMITTALS

A. Product Data: For each type of lighting fixture, arranged in order of fixture designation. Include data on features, accessories, finishes, and the following:

1. Physical description of lighting fixture including dimensions.
2. Emergency lighting units including battery and charger.
3. LED drivers.
4. Energy-efficiency data.
5. Air and Thermal Performance Data: For air-handling lighting fixtures. Furnish data required in "Submittals" Article in Division 15 Section "Diffusers, Registers, and Grilles."
6. Sound Performance Data: For air-handling lighting fixtures. Indicate sound power level and sound transmission class in test reports certified according to standards specified in Division 15 Section "Diffusers, Registers, and Grilles."
7. Life, output, and energy-efficiency data for lamps.
8. Photometric data, in IESNA format, based on laboratory tests of each lighting fixture type, outfitted with lamps, ballasts, and accessories identical to those indicated for the lighting fixture as applied in this Project.

B. Shop Drawings: Show details of nonstandard or custom lighting fixtures. Indicate dimensions, weights, methods of field assembly, components, features, and accessories.

1. Wiring Diagrams: Power **and control** wiring if any.

C. Coordination Drawings: Reflected ceiling plan(s) and other details, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:

1. Lighting fixtures.
2. Suspended ceiling components.
3. Structural members to which suspension systems for lighting fixtures will be attached.
4. Other items in finished ceiling including the following:

    a. Air outlets and inlets.
    b. Speakers.
    c. Sprinklers.
    d. Smoke and fire detectors.
    e. Occupancy sensors.
    f. Access panels.

5. Perimeter moldings.

D. Field quality-control test reports.

E. Operation and Maintenance Data: For lighting equipment and fixtures to include in emergency, operation, and maintenance manuals.

F. Warranties: Special warranties specified in this Section.

2.5 QUALITY ASSURANCE

A. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by manufacturers' laboratories that are accredited under the National Volunteer Laboratory Accreditation Program for Energy Efficient Lighting Products.

B. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by an independent agency, with the experience and capability to conduct the testing indicated, that is an NRTL as defined by OSHA in 29 CFR 1910.7.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

D. Comply with NFPA 70.
1.

2.6 COORDINATION

A. Coordinate layout and installation of lighting fixtures and suspension system with other construction that penetrates ceilings or is supported by them, including HVAC equipment, fire-suppression system, and partition assemblies.

2.7 WARRANTY

A. Special Warranty for Emergency Lighting Batteries: Manufacturer's standard form in which manufacturer of battery-powered emergency lighting unit agrees to repair or replace components of rechargeable batteries that fail in materials or workmanship within specified warranty period.

1. Warranty Period for Emergency Lighting Unit Batteries: **10** years from date of Substantial Completion. Full warranty shall apply for first year, and prorated warranty for the remaining nine years.

2. Warranty Period for LED light fixture: **Ten (10)** years from date of Substantial Completion.

2.8 EXTRA MATERIALS

PART 3 - PRODUCTS

3.1 MANUFACTURERS

A. In Interior Lighting Fixture Schedule where titles below are column or row headings that introduce lists, the following requirements apply to product selection:
1. Basis-of-Design Product: The design for each lighting fixture is based on the product named. Subject to compliance with requirements, provide either the named product or a comparable product by one of the other manufacturers specified.

3.2 LIGHTING FIXTURES AND COMPONENTS, GENERAL REQUIREMENTS

A. Recessed Fixtures: LED vandal resistant type fixtures Comply with NEMA LE 4 for ceiling compatibility for recessed fixtures.

B. Metal Parts: Free of burrs and sharp corners and edges.

C. Sheet Metal Components: Steel, unless otherwise indicated. Form and support to prevent warping and sagging.

D. Doors, Frames, and Other Internal Access: Vandal resistant accessible only with special tools.

E. Reflecting surfaces shall have minimum reflectance as follows, unless otherwise indicated:

1. White Surfaces: 85 percent.
2. Specular Surfaces: 83 percent.
3. Diffusing Specular Surfaces: 75 percent.
4. Laminated Silver Metallized Film: 90 percent.

F. Plastic Diffusers, Covers, and Globes:

1. Acrylic Lighting Diffusers: 100 percent virgin acrylic plastic. High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.

a. Lens Thickness: At least [**0.14 inch (3.6 mm)**] minimum unless different thickness is indicated.
b. UV stabilized.

G. Electromagnetic-Interference Filters: Factory installed to suppress conducted electromagnetic-interference as required by MIL-STD-461E. Fabricate lighting fixtures with drivers to minimize magnetic interference.

3.3 EXIT SIGNS

A. Description: Comply with UL 924; for sign colors, visibility, luminance, and lettering size, comply with authorities having jurisdiction.

B. Internally Lighted exit Signs:
1. Lamps for AC Operation: LEDs, 70,000 hours minimum rated lamp life.

3.4 LIGHTING FIXTURE SUPPORT COMPONENTS

A. Comply with Division 16 Section "Electrical Supports and Seismic Restraints" for channel- and angle-iron supports and nonmetallic channel and angle supports.

PART 4 - EXECUTION

4.1 INSTALLATION

A. Lighting fixtures: Set level, plumb, and square with ceilings and walls. Comply manufacturer’s instruction for vandal resistant fixtures

B. Support for Lighting Fixtures independent of Grid-Type Suspended Ceilings: Do not use grid as a support element.

C. Support lighting fixtures in sheet rock ceiling independent of the sheet rock ceiling. Do not use the ceiling as the main support for the recessed light fixture.

D. In isolation rooms coordinate the support of the light fixtures with the special construction for the ceiling in that area. Coordinate with the architectural detail for the ceiling in the isolation room.

E. Connect wiring according to Division 16 Section "Conductors and Cables."

F. Comply with the International Electric Code for separation of voltage systems originating from separate sources, for lighting fixtures being served with normal and emergency power.

4.2 FIELD QUALITY CONTROL

A. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery and retransfer to normal.

B. Prepare a written report of tests, inspections, observations, and verifications indicating and interpreting results. If adjustments are made to lighting system, retest to demonstrate compliance with standards.

END OF SECTION 16511